



DOW PRODUCTS

1966-1967



What Dow Offers You . . .

MODERN INDUSTRY—whether in this country or abroad—is characterized by a rapid and accelerating rate of growth and change, resulting in ever-increasing complexity. This dynamism has imposed additional burdens on chemical suppliers. Today's supplier, to keep pace, must offer, in addition to an expanding line of quality products, faster delivery, more exacting quality control, and more extensive technical service. Further, he must maintain a comprehensive program of research.

THE DOW CHEMICAL COMPANY has long recognized and accepted its growing responsibilities to its customers. Its willingness to expand customer service and research, as well as its production facilities and product line, has raised Dow to a preeminent position in the ranks of major chemical companies.

DOW PRODUCTION PLANTS now girdle the globe. In North America, manufacturing operations are carried out at 30 U.S.A. and 9 Canadian locations, while overseas operations encompass 24 subsidiary and associated companies located in 16 countries. Rigid quality control measures are used to control every step of the production process. Close product specifications are established and products reliably meet them.

DISTRIBUTION FACILITIES are unsurpassed, insuring smooth, rapid flow of products to Dow customers. Domestic sales offices are maintained in 20 cities, and overseas marketing is carried out through 35 Dow offices and sub-offices located in major cities on six continents. Within the United States alone, there are more than 90 facilities for bulk storage, packaging, formulation and warehousing. Warehousing of products at plant sites or in regional terminal warehouses is organized both to maintain product purity and to permit the filling of orders on extremely short notice.

DOW PRODUCTS TRAVEL to customers by truck, rail, plane, barge, and ship. A Dow barge fleet services both customers and terminals located on this country's inland waterways system. Three ocean-going transports with capacities ranging from 16,625 tons to 18,000 tons transport liquid and dry chemicals to coastal terminals and overseas customers. The company's transportation skills are supported by an effective communications network which uses the most advanced electronic technology, assuring quick transmission of information and

orders, and excellent materials control. Mixed shipments of many products are possible, giving the customer an added bonus of lower price.

THREE TECHNICAL SERVICE AND DEVELOPMENT ORGANIZATIONS AND NEARLY TWO-SCORE RESEARCH LABORATORIES further attest to Dow's determination to continue supplying customers with the services and new products they need. Dow's organization facilitates two-way communication with the customer through to basic research and back, insuring rapid and efficient action on any problems which arise. Provision of personalized technical service enables customers to make the best and most economical use of products in their own particular applications.

PROPERTIES AND USES of over 400 of the more important Dow products and services are presented in this booklet. These find application in industry, agriculture, building and construction, packaging, textiles, pharmacy and medicine, and in many other fields. While the great majority are basic chemicals in regular production, a small number—indicated by a dagger (†) in the index—are in the developmental stage. These items may or may not be immediately available in large quantities, but will in all cases be supported by technical information and samples available for the asking from Dow.

FOR MORE INFORMATION about any Dow product, or for technical information or samples, write to The Dow Chemical Company, Midland, Michigan 48640, or contact your nearest Dow Sales Office.

UNLESS OTHERWISE NOTED, properties of chemicals in this catalog have been determined on material believed to be representative of current Dow production. These values are intended to indicate the properties of chemicals regularly produced and are not to be interpreted as specifications. Information concerning specifications and methods of analysis is available at Dow sales offices. All information is presented in good faith, but no warranty is given, nor is freedom from any patent to be inferred.

TRADEMARKS of The Dow Chemical Company appearing in this booklet are set in large and small capital letters for more distinctive identification.

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alkylene oxides and glycols

Alkylene oxides are used as raw materials for the manufacture of glycols, alkanolamines, polyglycols, and glycol ether-type compounds. They are also utilized in the preparation of resins and resin modifiers, plasticizers, surface-active agents, pharmaceuticals, insecticides, dyestuffs, and dyestuff intermediates. Propylene oxide is employed as an intermediate.

Glycols are used as ingredients of permanent antifreeze formulations and coupling agents in brake fluids. They are utilized as

mold lubricants; plasticizers for cork, paper, cellophane, adhesives, packaging materials, and casein- and protein-base coatings; tobacco humectants; and solvents, preservatives, humectants, and coolants in human and pet foods, animal feeds, flavors, and pharmaceuticals. Glycols are also employed as resin intermediates, foam stabilizers, and solvents for vapor set inks, and in the manufacture of cosmetics, cutting oils, textile softeners and lubricants, and industrial hand soaps.

properties

PRODUCT	FORMULA	Description	Molecular weight	Freezing point °C.	Boiling point °C. 760 mm. Hg	Sp. gr. 25/25°C.	Lb./gal. at 25°C.	Refractive index at 25°C.	Flash point °F.	Viscosity at 25°C. centipoises	Approx. sol. g./100 g. solvent at 25°C.		
											water	methanol	ether
Ethylene Oxide	$\text{CH}_2\text{CH}_2\text{O}$	colorless liquid	44.1	-112.5	10.4	0.8966 (0/4°C.)	7.48 (0°C.)	1.3614 (4°C.)	below -20	0.31 (4°C.)	∞	∞	∞
Propylene Oxide	$\text{CH}_3\text{CHCH}_2\text{O}$	colorless liquid	58.1	-112	34.2	0.826	6.87	1.363	below -20	0.28	59	∞	∞
1,2-Butylene Oxide	$\text{C}_2\text{H}_5\text{CHCH}_2\text{O}$	colorless liquid	72.1	below -50	62-64.5	0.826	6.87	1.381	below -20	0.40	9.5	∞	∞
Ethylene Glycol	$\text{CH}_2\text{OHCH}_2\text{OH}$	colorless liquid	62.1	-13.5	197.3 ¹	1.113	9.26	1.430	240	16.5	∞	∞	3
Diethylene Glycol	$\text{HOC}_2\text{H}_4\text{OC}_2\text{H}_4\text{OH}$	colorless liquid	106.1	-8	244.8 ¹	1.116	9.29	1.446	280	28.2	∞	∞	4
Triethylene Glycol	$\text{HO}(\text{C}_2\text{H}_4\text{O})_2\text{C}_2\text{H}_4\text{OH}$	colorless liquid	150.2	-7	285.5	1.122	9.34	1.454	320	37.3	∞	∞	5
Tetraethylene Glycol	$\text{HO}(\text{C}_2\text{H}_4\text{O})_3\text{C}_2\text{H}_4\text{OH}$	nearly colorless liquid	194.2	-6	314	1.123	9.34	1.457	365	44.6	∞	∞	7
Propylene Glycol, U.S.P.	$\text{CH}_3\text{CHOHCH}_2\text{OH}$	colorless liquid	76.1	supercools	187.2	1.036	8.62	1.431	215	44.0	∞	∞	∞
Propylene Glycol, Industrial	$\text{CH}_3\text{CHOHCH}_2\text{OH}$	colorless liquid	76.1	supercools	187.2	1.036	8.62	1.431	215	44.0	∞	∞	∞
Dipropylene Glycol	$\text{HOC}_3\text{H}_6\text{OC}_3\text{H}_6\text{OH}$	colorless liquid	134.2	supercools	231.0	1.025	8.54	1.439	260	74.1	∞	∞	∞
Tripropylene Glycol	$\text{HO}(\text{C}_3\text{H}_6\text{O})_2\text{C}_3\text{H}_6\text{OH}$	colorless liquid	192.3	supercools	268.0	1.019	8.51	1.442	285	56.2	∞	∞	∞

¹ Pure compound

glycol ethers

The DOWANOL® glycol ethers have excellent solubility properties which make them valuable in a wide variety of applications. Products in which they are used as solvents include brake-fluid formulations, agricultural chemicals, rust and carbon removers, cutting oils, detergent solutions, floor-cleaning compounds, metal parts cleaners, textile-treating compounds, cellulose lac-

quers, and duplicating inks. They are also used as solvents in the dyeing of wood, fibers, and feathers and in sealing moisture-proof cellophane. Other uses are: intermediates in the manufacture of plasticizers, bactericidal agents, and fixatives for soaps and perfumes.

properties

PRODUCT	FORMULA	Description	Molecular weight	Pour point °F.	Boiling point °C. at 760 mm. Hg	Sp. gr. 25/25°C.	Lb./gal. at 25°C.	Refractive index at 25°C.	Flash point °F.	Viscosity, centistokes		Approx. sol. g./100g. solvent at 25°C.		
										25°C.	60°C.	water	methanol	ether
DOWANOL EP Ethylene Glycol Phenyl Ether	$C_6H_5OC_2H_4OH$	nearly colorless liquid	138.2	55 ¹	245	1.106	9.20	1.536	260	18.6	4.13	<0.1	∞	∞
DOWANOL EM Ethylene Glycol Methyl Ether	$CH_3OC_2H_4OH$	colorless liquid	76.1	-124 ¹	124.6	0.963	8.01	1.400	120	1.60	0.92	∞	∞	∞
DOWANOL EE Ethylene Glycol Ethyl Ether	$C_2H_5OC_2H_4OH$	colorless liquid	90.1	-148 ²	135.5	0.928	7.72	1.406	140	2.00	1.06	∞	∞	∞
DOWANOL EB Ethylene Glycol n-Butyl Ether	$C_4H_9OC_2H_4OH$	colorless liquid	118.2	-103 ¹	171.1	0.900	7.49	1.417	165	3.15	1.51	∞	∞	∞
DOWANOL DM Diethylene Glycol Methyl Ether	$CH_3(OC_2H_4)_2OH$	colorless liquid	120.1	-121	194.2	1.018	8.47	1.424	200	3.42	1.67	∞	∞	∞
DOWANOL DE Diethylene Glycol Ethyl Ether	$C_2H_5(OC_2H_4)_2OH$	colorless liquid	134.2	-130	202.0	0.988	8.22	1.425	205	3.85	1.79	∞	∞	∞
DOWANOL DE-SG	—	colorless liquid	—	—	193-202 ³	1.023	8.51	1.427	215	5.92	2.43	∞	∞	∞
DOWANOL DB Diethylene Glycol n-Butyl Ether	$C_4H_9(OC_2H_4)_2OH$	colorless liquid	162.2	-105 ²	230.0	0.952	7.92	1.430	230	5.17	2.27	∞	∞	∞
DOWANOL PM Propylene Glycol Methyl Ether	$CH_3OCH_2CHOHCH_3$	colorless liquid	90.1	-142	120.1	0.919	7.65	1.402	100	1.86	0.95	∞	∞	∞
DOWANOL DPM Dipropylene Glycol Methyl Ether	$CH_3(OC_3H_6)_2OH$	colorless liquid	148.2	-117	188.3	0.951	7.91	1.419	185	3.57	1.60	∞	∞	∞
DOWANOL TPM Tripropylene Glycol Methyl Ether	$CH_3(OC_3H_6)_3OH$	colorless liquid	206.3	-108	242.4	0.965	8.03	1.428	250	5.80	2.32	∞	∞	∞
DOWANOL P-MIX Mixture of PM, DPM, TPM	—	colorless liquid	—	-120	143 ³	0.944	7.86	1.416	120	3.11	1.42	∞	∞	∞
DOWANOL PiBT Mixture of isobutyl ethers of propylene glycol and its homologs	—	colorless liquid	—	—	170-173 ⁴	0.882	7.33	—	145	—	—	3.8	∞	∞

¹ Freezing point

² Sets to a glasslike solid; no freezing point

³ Reflux boiling point

⁴ Boiling range

polyglycols

Polyglycols of the "E" series find application as water-soluble ointment bases, ingredients of lotions and suppositories, and tablet coatings, as carriers and bases in cosmetics, as mold release agents, lubricants, and curing catalysts in the rubber industry, as plasticizers for cork and sponges, as ingredients in metal fabricating and lubricating formulations, as modifiers in water-dispersible alkyd resin paints, as plasticizers and anti-sticking agents, as paper surface sizings, as ingredients in adhesives for ceramics, and in many other areas.

The polyglycols of the "P" series are utilized as coupling agents in cutting oils, as lubricants in metal rolling, forming, and drawing, as antifoam agents in ceramic glaze solutions, latex paints, methanol antifreezes, and pharmaceutical fermentation processes, as cosmetic ingredients, as rubber lubricants and mold release agents, as urethane intermediates, as lubricants in brake fluid formulations, and as flotation froth control agents.

AMBIFLO® lubricants combine a number of outstanding characteristics that recommend them for a wide range of uses. Such

applications include lubricants in brake fluid formulations, textile fiber lubricants, components in rubber mold release formulations, components in metalworking formulations, and compressor lubricants. In addition, AMBIFLO lubricants show promise as components in cosmetic formulations, and as defoamers, gear lubricants, hydraulic fluids, and low temperature fluids.

A number of the newer polyglycols show especially bright promise as intermediates in the production of many types of urethanes, including flexible foams, rigid and semi-rigid foams, adhesives and molding resins.

In addition, these polyglycols have been used or suggested as plasticizers for waxes and cellulose, as detergent intermediates, as couplers in brake fluid formulations, as cosmetic and pharmaceutical ingredients, as lubricants in the rubber, textile, and metalworking industries, as rubber mold release agents, and as petroleum demulsifiers.

properties

PRODUCT AND FORMULA	Description	Average molec- ular weight	Specific gravity 25°/25°C.	Pounds per gallon at 25°C.	Refrac- tive index at 25°C.	Pour point °F.	Flash point °F.	Fire point °F.	Viscosity, centistokes				Viscos- ity index	Approx. sol. g./100 g. solvent at 25°C.		
									32°F.	77°F.	100°F.	210°F.		water	methanol	ether
Polyethylene Glycols																
Polyglycol E200 HO(C ₂ H ₄ O) _n C ₂ H ₄ OH	viscous liquid	200	1.124	9.35	1.459	super- cools	360	365	187	39.9	20.0	4.4	—	∞	∞	11.0
Polyglycol E300 HO(C ₂ H ₄ O) _n C ₂ H ₄ OH	viscous liquid	300	1.125	9.36	1.463	15 ¹	415	435	343	68.8	36.0	5.7	110	∞	∞	7.0
Polyglycol E400 HO(C ₂ H ₄ O) _n C ₂ H ₄ OH	viscous liquid	400	1.125	9.36	1.465	43 ¹	460	500	solid	90.0	49.0	7.4	121	∞	∞	5.0
Polyglycol E600 HO(C ₂ H ₄ O) _n C ₂ H ₄ OH	viscous liquid	600	1.126	9.37	1.466	73 ¹	480	545	solid	131	72.0	11.0	138	∞	∞	4.0
Polyglycol E1000 HO(C ₂ H ₄ O) _n C ₂ H ₄ OH	waxlike solid	1000	1.117	—	—	100 ¹	490	580	solid	solid	solid	18.5	—	∞	>100	4.0
Polyglycol E500M HO(C ₂ H ₄ O) _n C ₂ H ₄ OH	waxlike solid	(mixture) 550	1.200	—	—	104 ¹	430	470	solid	solid	solid	16	—	∞	>100	<0.1
Polyglycol E1450 HO(C ₂ H ₄ O) _n C ₂ H ₄ OH	waxlike solid	1450	1.210	—	—	113 ¹	490	590	solid	solid	solid	29	—	∞	>100	<0.1
Polyglycol E2000 HO(C ₂ H ₄ O) _n C ₂ H ₄ OH	waxlike solid	2000	1.211	—	—	120 ¹	510	590	solid	solid	solid	47	—	∞	67	<0.1
Polyglycol E4000 HO(C ₂ H ₄ O) _n C ₂ H ₄ OH	waxlike solid	4500	1.212	—	—	133 ¹	515	590	solid	solid	solid	180	—	∞	28	<0.1
Polyethylene Glycol 4000, U.S.P. HO(C ₂ H ₄ O) _n C ₂ H ₄ OH	waxlike solid	3400	1.212	—	—	129 ¹	515	590	solid	solid	solid	80	—	∞	38	<0.1
Polyglycol E6000 HO(C ₂ H ₄ O) _n C ₂ H ₄ OH	waxlike solid	7500	1.212	—	—	136 ¹	515	600	solid	solid	solid	580	—	∞	10	<0.1
Polyglycol E9000 HO(C ₂ H ₄ O) _n C ₂ H ₄ OH	waxlike solid	9500	1.212	—	—	143 ¹	520	600	solid	solid	solid	1120	—	∞	<0.1	<0.1
Polypropylene Glycols																
Polyglycol P400 ² HO(C ₃ H ₆ O) _n C ₃ H ₆ OH	viscous liquid	400	1.007	8.38	1.445	—49	390	405	491	70	35.2	4.9	53	∞	∞	∞
Polyglycol P1200 ² HO(C ₃ H ₆ O) _n C ₃ H ₆ OH	viscous liquid	1200	1.003	8.35	1.448	—40	460	505	1180	160	93.1	13.7	135	2	∞	∞
Polyglycol P2000 ² HO(C ₃ H ₆ O) _n C ₃ H ₆ OH	viscous liquid	2000	1.002	8.34	1.450	—31	445	510	1880	230	164.0	23.9	137	<0.1	∞	∞
Polyglycol P4000 ² HO(C ₃ H ₆ O) _n C ₃ H ₆ OH	viscous liquid	4000	1.001	8.33	1.449	—20	440	510	7117	1114	545	73.5	130	<0.1	>100	>100

¹ Freezing point

² Also available in special resin grade for use as urethane intermediate, see page no. 24.

other polyglycols

properties

PRODUCT AND FORMULA	Description	Average molecular weight	Specific gravity 25/25° C.	Pounds per gallon at 25° C.	Refrac- tive index at 25° C.	Pour point ° F.	Flash point ° F.	Fire point ° F.	Viscosity, centistokes				Viscos- ity index	Approx. sol. g./100 g. solvent at 25° C.		
									32° F.	77° F.	100° F.	210° F.		water	methanol	ether
AMBIFLO Lubricants																
AMBIFLO H-149	viscous liquid	1700	1.0456 ¹	8.70 ²	—	—33	470	510	1500	280	149	26.90	144	∞	∞	sl. sol.
AMBIFLO H-813	very viscous liquid	3600	1.0576	8.77	—	—15	470	530	9500	1600	813	—	133	∞	∞	sl. sol.
AMBIFLO L-317	very viscous liquid	3900	1.0087 ¹	8.39 ²	—	—20	470	500	4000	600	317	50.0	135	<0.1	∞	∞
Other Polyglycols																
Polyglycol 15-200 CH ₂ O(C ₂ H ₄ O, C ₃ H ₆ O) _n H CHO(C ₂ H ₄ O, C ₃ H ₆ O) _n H CH ₂ O(C ₂ H ₄ O, C ₃ H ₆ O) _n H	viscous liquid	2600	1.063	8.85	1.460	—40	470	550	1350	360	206	32.3	138	∞	∞	∞
Polyglycol 112-2 A triol derived from ethylene and propylene oxides	viscous liquid	—	1.023	8.51	1.454	—18	485	520	4017	659	344	50.0	134	<0.1	>100	>100

¹ Density, 60°F.² 60°F.

glycerine

Glycerine is used in adhesives, alkyd resins, cellophane, cork, inks, paper, pharmaceuticals, and oleomargarine.
rubber, tobacco, dentifrices, emulsifiers, cosmetics, dynamite,

properties

PRODUCT	FORMULA	Description	Molecu- lar weight	Melting point °C.	Boiling point °C. at 760 mm. Hg	Specific gravity 25/25°C.	Lb./gal. at 25°C.	Refrac- tive index at 25°C.	Flash point °F.	Viscosity, centi- poises 25°C.	Approx. sol. g./100g. solvent at 25°C.		
											water	methanol	ether
Glycerine, 99.5%	HOCH ₂ CHOHCH ₂ OH	colorless liquid	92.1	17.9	290.0	1.262	10.50	1.472	350	945	∞	∞	sl. sol.
Glycerine, U.S.P. 96%	HOCH ₂ CHOHCH ₂ OH	colorless liquid	92.1	9.5 ¹	175.0	1.2517	10.41	1.4675	—	435	∞	∞	sl. sol.
Glycerine, U.S.P. 99.5%	HOCH ₂ CHOHCH ₂ OH	colorless liquid	92.1	17.9	290.0	1.262	10.50	1.472	350	945	∞	∞	sl. sol.

¹ Freezing point

antimicrobial agents

DOWICIDE® antimicrobial agents are used by industry and agriculture for the control of bacteria and fungi. Products in which they are incorporated as preservatives include adhesives, wallboard, insulation, calcimine, latex paints, oil-based paints, varnishes and lacquers, paper and paper coatings, cutting oils, printing inks, floor polishes and waxes, synthetic latexes, and slime-control compounds. Several of the DOWICIDE products are also effective wood preservatives, furnishing protection against both insects and microorganisms. Others are utilized in tanning leather and in the formulation of disinfectants, germicides, and herbicides. DOWICIDE 1 and DOWICIDE A are used as dye assistants for synthetic fibers, and in the treatment of fresh fruits and vegetables.

DOWICIL® 100 preservative has excellent aqueous solubility and provides outstanding protection against the microbiological deterioration of numerous water-containing products including soluble cutting oils, latexes and latex paints, gums and adhesives, wet paper coatings, floor waxes, and floor finishes.

TUASAL® 85 and TUASAL 100 bacteriostats have a high degree of activity against a broad spectrum of microorganisms. Their order of toxicity is low—no skin irritation or sensitization has been shown at use concentrations. The skin and cellulose substantivity properties of these products impart desirable characteristics to deodorant soaps, laundry detergents, cosmetic preparations and other products for which bacteriostatic effects are desirable.

properties

PRODUCT	FORMULA	Description	Molecular weight	Approx. bulk density lb./cu. ft.	pH water saturated solution at 25°C.	Approx. sol. g./100g. solvent at 25°C.							
						water	methanol	acetone	DOWANOL PM	polyglycol P400	pine oil	stoddard	toluene
DOWICIDE 1 o-Phenylphenol	$C_6H_4(C_6H_5)OH$	white to light-buff or pink flakes	170.2	35-41	7.3	<0.1	975	670	412	176	257	—	—
DOWICIDE 2 2,4, 5-Trichlorophenol	$C_6H_2Cl_3OH$	gray flakes to a sublimed mass	197.5	43-47	4.5	<0.2	615	615	446	284	80 neatsfoot oil	—	122
DOWICIDE 2S 2,4,6-Trichlorophenol	$C_6H_2Cl_3OH$	yellowish, crystalline flakes	197.5	43-47	—	<0.1	525	525	321	214	163	16	100
DOWICIDE 4 2-Chloro-4-phenylphenol	$C_6H_3(C_6H_5)ClOH$	white flakes	204.6	34-40	—	<0.1	355	355	312	133	73	—	—
DOWICIDE 6¹ 2,3,4,6-Tetrachlorophenol	C_6HCl_4OH	light-brown flakes	231.9	38-46	4.6	<0.1	319	570	384	173	203	20	175
DOWICIDE 7² Pentachlorophenol	C_6Cl_5OH	dark-colored flakes and sublimed needle crystals	266.4	47-58	5.7	<0.1	202	53	98	95	89	4	16
DOWICIDE 32³ Mixture of 4 and 6 Chloro-2-phenylphenol	$C_6H_3(C_6H_5)ClOH$	colorless to straw-colored, viscous liquid	204.6	10.3 ⁴	5.8	<0.1	∞	comp. sol.	comp. sol.	comp. sol.	comp. sol.	comp. sol.	comp. sol.
DOWICIDE A o-Phenylphenol, Sodium Salt, Tetrahydrate	$C_6H_4(C_6H_5)ONa \cdot 4 H_2O$	practically white flakes and fines or ground flakes	264.3	38-43	12.0-13.5	133	138	156	239	24	<0.1	<0.1	—
DOWICIDE B 2,4,5-Trichlorophenol, Sodium Salt, 1½ Hydrate	$C_6H_2Cl_3ONa \cdot 1.5 H_2O$	buff to light-brown flakes and fines	246.4	28-33	11.0-13.0	113	241	163	201	29	—	—	—
DOWICIDE G Pentachlorophenol, Sodium Salt, Monohydrate	$C_6Cl_5ONa \cdot H_2O$	buff-colored beads, flakes and ground form	306.3	20-24	9.0-11.5	33	22	37	39	14	<0.1 turpentine	—	—
DOWICIL 100 1-(3-Chloroallyl)-3,5,7-triaza-1-azoniaadamantane Chloride	$C_{12}H_{12}N_3(CH_2CHCHCl)Cl$	white to cream-colored powder	251.2	50	—	>100	>20	0.05	0.42	—	—	0.06 hexane	—
TUASAL 85 Mixture of 3,5-Di- and 3,4,5-Tribrominated Salicylanilide	—	off-white powder	—	25	—	<0.001	<0.03 ethanol	15	18.4	5.38 polyglycol P4000	—	—	—
TUASAL 100 3,4,5-Tribrominated Salicylanilide	—	off-white powder	—	25	—	<0.001	1.0	6.3	5.85	—	—	—	—

¹ Also available as 70% concentrate in DOWANOL PM

² Also available in oiled grade

³ Also available in technical grade as DOWICIDE 31

⁴ Lb./gallon

phenol and phenol derivatives

A wide variety of products is made from phenol intermediates. Included among these are synthetic resins and plastics, agricultural chemicals, pharmaceuticals, dye intermediates, photographic chemicals, and synthetic perfumes. Phenol is also used in the manufacture of germicidal and disinfecting

paints and soaps, as a preservative in the leather, glue, and adhesive industries, and in the refining of low-grade distillate by the petroleum industry. 4-tert-Butylcatechol is suggested as a stabilizer for monomeric styrene, butadiene, and vinyltoluene.

properties

PRODUCT	FORMULA	Description	Molecular weight	Freezing point °C.	Boiling point °C. 760 mm. Hg	Sp. gr. 25/25°C.	Lb./gal. at 25°C.	Flash point °F.	Approx. sol. g./100 g. solvent at 25°C.		
									water	methanol	ether
Bisphenol A p,p'-Isopropylidenediphenol	$(\text{CH}_3)_2\text{C}(\text{C}_6\text{H}_4\text{OH})_2$	white to cream flakes	228.3	154.5	220 (4mm. Hg)	1.038 (200/4°C.)	8.6	—	<0.1	210	33
4-tert-Butylcatechol	$(\text{CH}_3)_3\text{CC}_6\text{H}_3(\text{OH})_2$	white, crystalline solid	166.2	52	285	1.049 (60/25°C.)	8.73 (60°C.)	265	0.2	500	240
o-sec-Butylphenol	$(\text{CH}_3\text{CH}_2\text{C}_2\text{H}_4)\text{C}_6\text{H}_4\text{OH}$	colorless liquid	150.2	14	226-228 ¹	0.981	8.16	225	0.3	∞	∞
p-sec-Butylphenol	$(\text{CH}_3\text{CH}_2\text{C}_2\text{H}_4)\text{C}_6\text{H}_4\text{OH}$	white to slightly yellow, crystalline solid	150.2	51	135.4-136.5 ¹ (25mm. Hg)	0.963 (60/60°C.)	7.89 (60°C.)	240	0.1	681	639
p-tert-Butylphenol	$(\text{CH}_3)_3\text{CC}_6\text{H}_4\text{OH}$	white flakes	150.2	98	151 (50mm. Hg)	1.037	—	245	0.1	254	sol.
o-Chlorophenol	$\text{ClC}_6\text{H}_4\text{OH}$	colorless to light amber liquid	128.6	8.2	175-176 ¹	1.256	10.45	165	<1	∞	∞
p-Chlorophenol	$\text{ClC}_6\text{H}_4\text{OH}$	white to straw-colored, crystalline solid	128.6	43	220	1.246 (60/25°C.)	10.39 (60°C.)	240	<1	∞	∞
2, 4-Dichlorophenol	$\text{C}_6\text{H}_3\text{Cl}_2\text{OH}$	white, crystalline solid	163	41.5 and 42.3 ²	—	1.385 (60/4°C.)	11.56 (60°C.)	245	0.4	1147	614
PARABIS* A Purified p,p'-Isopropylidenediphenol	$(\text{CH}_3)_2\text{C}(\text{C}_6\text{H}_4\text{OH})_2$	white crystals	228.3	156.5	220 (4mm. Hg)	1.038 (200/4°C.)	8.6	—	<0.1	409	44
Phenol, U.S.P.³	$\text{C}_6\text{H}_5\text{OH}$	white, crystalline solid	94.1	40.9 ^{4,5}	181.75 ⁵	1.0413 ⁵ (60/4°C.)	8.69 (60°C.)	174	9.5	∞	∞
Phenolsulfonic Acid (65% solution)	$\text{C}_6\text{H}_4\text{OHSO}_3\text{H}$	dark reddish-brown liquid	174.2	8	—	1.34	11.25	none	∞	∞	∞
p-Phenylphenol	$\text{C}_6\text{H}_5\text{C}_6\text{H}_4\text{OH}$	white flakes	170.2	166.5	321	1.275	—	330	<0.1	36	27

¹ Boiling range, 5-95%
² Crystallizes in two forms

³ Also available in water solutions

⁴ Congealing point
⁵ Pure compound

*Trademark

organic acids and esters

Organic acids and esters are used in the preparation of weed killers, photographic chemicals, dyes, vitamins, and pharmaceuticals, and in numerous other organic syntheses. Ethyl chloroacetate is a solvent.

DOWANOL EEA solvent is a high-boiling, slow-evaporating product which exhibits strong solvency toward many oils, gums, and natural and synthetic resins.

properties

PRODUCT	FORMULA	Description	Molecular weight	Freezing point °C.	Boiling point °C. 760mm. Hg	Sp. gr. 25/25°C.	Lb./gal. at 25°C.	Refractive index 25°C.	Flash point °F.	Approx. sol. g./100g. solvent at 25°C.		
										water	methanol	ether
Chloroacetic Acid	ClCH_2COOH	white crystals	94.5	62.6 ²	188.8 ²	1.3764 ² (60/4°C.) (liquid)	—	1.4330 ² (60°C.) (liquid)	none	510	350	190
DOWANOL EEA Ethylene Glycol Ethyl Ether Acetate	$\text{CH}_3\text{COOC}_2\text{H}_4\text{OC}_2\text{H}_5$	colorless liquid	132.2	—61.7	156.2	0.9708	8.08	1.4034	135	22.9	∞	∞
Ethyl Chloroacetate	$\text{ClCH}_2\text{COOC}_2\text{H}_5$	colorless liquid	122.6	—26	143	1.148	9.55	1.419	150	reacts	∞	∞
Methyl Chloroacetate	$\text{ClCH}_2\text{COOCH}_3$	colorless liquid	108.5	below —30	128-132 ³	1.227	10.21	1.419	135	<1	∞	∞
Mono- and Dichloroacetic Acid Mixtures⁴	—	yellow liquid	—	—	—	—	—	—	—	—	—	—
Sodium Chloroacetate, Technical	$\text{ClCH}_2\text{COONa}$	white powder	116.5	decomposes ¹	—	—	—	—	none	86	6	<0.1
Trichloroacetic Acid, U.S.P.⁵	CCl_3COOH	white, deliquescent crystals	163.4	55-58 ¹	—	—	—	—	none	1306	2143	617

¹ Melting point

² Pure compound

³ Boiling range, 5-95%

⁴ See also Chloroacetic Acid

⁵ Also available in technical grade

organic chelating agents

The VERSENE®, VERSENEX®, VERSENOL®, and Iron Specialty chelating agents react stoichiometrically with polyvalent metal ions to form extremely stable and soluble metal chelates. VERSENE, VERSENEX and VERSENOL will all chelate a great variety of metal ions over a wide pH range. The Iron Specialty series was specifically developed for the control of iron under alkaline conditions. Dow chelating agents have found a wide variety of applications in the prevention or solution of problems associated with metal ions. Improved shelf life and increased detergency are the results of using Dow chelating agents in soap or detergent formulations. The textile industry has made wide use of these products in dyeing, scouring and bleaching operations.

Other uses for the chelating agents are: rubber polymerization, latex stabilization, recovery of rare earths, descaling and scale prevention in boilers and heat exchangers, metal cleaning, and the manufacture of fertilizers. VERSENE CA chelate is a highly purified preparation of the calcium chelate of the disodium salt of ethylenediaminetetraacetic acid, commonly called calcium EDTA, produced especially for use as a food additive. The principal function of the product is to chemically bind and render inactive those trace metals having an adverse effect upon the color, clarity, stability or other characteristics of foods. VERSENE NA is likewise produced specially for use as a food additive. Chemically it is disodium dihydrogen ethylenediaminetetraacetate.

properties

PRODUCT	FORMULA OF ACTIVE INGREDIENT	Description	Active ingredient molecular weight	Freezing point °C.	Boiling point °C. 760 mm. Hg	Sp. gr. 25/25°C.	Bulk density lbs./gal.	pH of 1% solution	Chelation values ¹	Approx. sol. g./100g. solvent at 25°C.		
										water	methanol	ether
VERSENE												
VERSENE acid EDTA	C ₁₀ H ₁₆ O ₈ N ₂	white powder	292.2	—	240 ²	—	5.0	—	339	<0.5	<0.1	<0.1
VERSENE 100 Na ₄ EDTA	C ₁₀ H ₁₂ O ₈ N ₂ Na ₄	light straw-colored liquid	380.2	—29	107	1.31	10.9	11.3	100	∞	∞	<0.1
VERSENE flake Na ₄ EDTA	C ₁₀ H ₁₂ O ₈ N ₂ Na ₄	white flakes	380.2	—	—	—	3.1	11.0	215	120	<0.1	<0.1
VERSENE powder Na ₄ EDTA	C ₁₀ H ₁₂ O ₈ N ₂ Na ₄	white powder	380.2	—	—	—	5.0	11.0	215	120	<0.1	<0.1
VERSENE CA CaNa ₂ EDTA	C ₁₀ H ₁₂ O ₈ N ₂ CaNa ₂ ·2H ₂ O	white powder	410.3	—	—	—	—	7.0 ³	—	—	—	—
VERSENE NA Na ₂ EDTA	C ₁₀ H ₁₄ O ₈ N ₂ Na ₂ ·2H ₂ O	white powder	372.1	—	—	—	—	4.5	—	—	—	—
VERSENEX												
VERSENEX 80 Na ₅ DTPA	C ₁₄ H ₁₈ O ₁₀ N ₃ Na ₅	straw-colored liquid	503.2	—	—	1.31	10.9	11.3	80	∞	—	—
VERSENOL												
VERSENOL 120 Na ₃ HEDTA	C ₁₀ H ₁₆ O ₇ N ₂ Na ₃	light straw-colored liquid	344.2	<—20	108	1.31	10.9	11.3	120	∞	∞	<0.1
on Specialty Series												
VERSENE FE-3 SPECIFIC® NaDHEG	C ₆ H ₁₂ O ₄ NNa	straw-colored liquid	185.2	<—20	107	1.20	10.0	11.3	See note 4	∞	∞	<0.1
VERSENE FE-3 liquid	—	straw-colored liquid	—	<—13	104	1.20	10.0	11.3	62	∞	∞	<0.1
VERSENE FE-3 powder	—	white powder	—	—	—	—	7.1	11.0	193	140	<0.1	<0.1

¹ Number of milligrams of calcium chelated as calcium carbonate at pH 11 by 1 gram of chelating agent

² Decomposition temperature

³ 15% solution

⁴ Contains 41% active chelating agent based on product composition

brominated organic compounds*

Brominated organic compounds are widely used in the synthesis of pharmaceuticals, dyes, quaternary ammonium compounds, and other organic compounds. In many reactions they are utilized as a source of readily available aliphatic radicals. A number of the brominated aliphatics are themselves useful

as sedatives, antibacterials, fire retardants, refrigerants, fire extinguishants, soil and space fumigants, ingredients in anti-knock fluids, solvents for gums and waxes, and high-specific-gravity liquids.

properties

PRODUCT	FORMULA	Description	Molecular weight	Freezing point °C.	Boiling point °C. 760mm. Hg	Sp. gr. 25/25°C.	Lb./gal. at 25°C.	Refractive index at 25°C.	Flash point °F.	Approx. sol. g./100g. solvent at 25°C.		
										water	methanol	ether
Acetylene Tetrabromide	$\text{CHBr}_2\text{CHBr}_2$	pale yellow liquid	345.7	-1.0	239 with decomposition	2.961	24.64	1.635	none	<0.1	∞	∞
ALKAZENE® 42 ar-Dibromoethylbenzene	$\text{C}_6\text{H}_3\text{C}_2\text{H}_5\text{Br}_2$	colorless liquid	264.0	-40	262	1.744	14.51	1.587	none	ins.	50	∞
Allyl Bromide	$\text{CH}_2=\text{CHCH}_2\text{Br}$	colorless to pale yellow liquid	121.0	below -50	70.2	1.418	11.80	1.465	30	<0.1	∞	∞
Bromobenzene	$\text{C}_6\text{H}_5\text{Br}$	colorless liquid	157.0	-30.6	156.0	1.495	12.44	1.557	125	0.05 (30°C.)	∞	∞
1-Bromo-4-chlorobenzene	$\text{C}_6\text{H}_4\text{BrCl}$	white crystals	191.5	64.5	196	—	—	—	none	<0.1	27	157
Bromochloromethane	CH_2BrCl	colorless to pale yellow liquid	129.4	-88	67.8	1.930	16.06	1.480	none	0.9	∞	∞
Bromoform	CHBr_3	colorless, heavy liquid	252.8	7.8	148	2.850	23.72	1.594	none	0.1	∞	∞
p-Dibromobenzene	$\text{C}_6\text{H}_4\text{Br}_2$	nearly white crystals	235.9	87.5 ¹	218.6	—	—	—	none	<0.1	8	101
Dibromodifluoromethane	CBr_2F_2	colorless, heavy liquid	242.8	22	133.7	2.408	20.0	1.496	none	—	—	—
Ethyl Bromide	$\text{C}_2\text{H}_5\text{Br}$	colorless liquid	109.0	-119.0	38.4	1.451	12.07	1.421	none	0.9	∞	∞
Ethylene Dibromide	$\text{CH}_2\text{BrCH}_2\text{Br}$	colorless liquid	187.9	9.8	131.4	2.172	18.07	1.536	none	0.27	∞	∞
Gauge Fluid R-200	—	colorless, heavy liquid	—	0	250-300 ²	2.000	16.7	—	none	<0.1	17	∞
Lauryl Bromide	$\text{CH}_3(\text{CH}_2)_{10}\text{CH}_2\text{Br}$	viscous yellow liquid	249.2	-10	142 (10mm. Hg)	1.021	8.5	1.457	295	<0.1	11	∞
Methyl Bromide	CH_3Br	colorless gas	95.0	-93	3.6	1.732 (0/0°C.)	14.45 (0°C.)	—	none	0.09 (20°C.)	44	39
Methylene Bromide	CH_2Br_2	colorless to pale yellow heavy liquid	173.9	-52	99	2.490	20.58	1.538	none	0.1	∞	∞
Tetrabromo Bisphenol A	$(\text{CH}_3)_2\text{C}(\text{C}_6\text{H}_2\text{Br}_2\text{OH})_2$	off-white powder	543.9	181	—	—	—	—	above 600	<0.1	92	97
Trimethylene Chlorobromide	$(\text{CH}_2)_3\text{BrCl}$	colorless to pale yellow liquid	157.5	below -50	143.5	1.594	13.27	1.484	none	ins.	∞	∞
Vinyl Bromide	$\text{CH}_2=\text{CHBr}$	colorless liquid	106.9	-139.5	15.8	1.474 ³	12.4	1.435	—	—	—	—

¹ Melting point

² Boiling range

³ Density, gm./ml.

*Dow's "Bromine and Brominated Products Handbook," available upon request, contains physical property data on some 100 bromine compounds.

12 chlorinated organic compounds

Chlorinated aliphatics find wide use as commercial and industrial solvents. Typical applications include dry cleaning, white room cleaning applications, liquid and vapor-phase degreasing, the dissolving, extraction and processing of organic materials, and preparation of paint and carbon-removal formulations. Individual compounds also find use as dye-assist agents,

lubricating oil additives, fumigants, insecticides, antimicrobials, anesthetics, refrigerants, fire extinguishants, ingredients of sanitary specialties and deodorants, and intermediates in organic synthesis. Epichlorohydrin and vinylidene chloride are employed as monomers for the production of resins and plastics.

properties

PRODUCT	FORMULA	Description	Molecular weight	Freezing point °C.	Boiling point °C. 760 mm. Hg	Sp. gr. 25/25°C.	Lb./gal. at 25°C.	Refractive index at 25°C.	Flash point °F.	Approx. sol. g./100g. solvent at 25°C.		
										water	methanol	ether
Allyl Chloride	$\text{CH}_2\text{CHCH}_2\text{Cl}$	colorless liquid	76.5	-136.5	44.99	0.931	7.75	1.415	-20	0.33	∞	∞
Carbon Tetrachloride, Technical¹	CCl_4	colorless liquid	153.8	-23.0 ²	76.54 ²	1.589	13.22	1.457	none	<0.1	∞	∞
Chloroacetyl Chloride	ClCH_2COCl	colorless to slightly yellow liquid	113.0	-22.5	105.5-106.5 ³	1.417	11.79	1.451	none	decomposes	decomposes	∞
Chloroform, Technical⁴	CHCl_3	colorless liquid	119.4	-63.5	60.8	1.476	12.27	1.443	none	0.8	∞	∞
CHLOROTHENE® NU Inhibited 1,1,1-Trichloroethane	—	colorless liquid	133.4	-37.9	73-84 ³	1.319	10.97	1.435	none	<0.1	∞	∞
CHLOROTHENE, Industrial Inhibited 1,1,1-Trichloroethane	—	colorless liquid	133.4	-50	73-84 ³	1.319	10.97	1.435	none	<0.1	∞	∞
o-DICHLOROBENZENE	$\text{C}_6\text{H}_4\text{Cl}_2$	colorless liquid	147.0	-22	180.4 ²	1.303	10.84	1.548	155	0.008	∞	∞
1,1-Dichloroethane	CCl_2HCH_3	colorless liquid	99.0	-96.7 ²	57.3 ²	1.165	9.68	1.417 (20°C.)	10	<0.1	∞	∞
Dichloroethyl Ether, Purified⁵	$(\text{ClCH}_2\text{H})_2\text{O}$	colorless liquid	143.0	-46	177.5-178.5 ³	1.216	10.12	1.455	185	0.85	∞	∞
1,2-Dichloroethylene (Mixed isomers)	CHCl:CHCl	colorless liquid	97.0	-57	46-64 ⁶	1.265	10.54	1.445	30	0.6	∞	∞
DOWCLEN® EC Electric cleaning solvent	—	colorless liquid	—	-56.6	77-122 ³	1.381	11.50	—	none	<0.1	∞	∞
DOWCLEN® WR White Room Grade Inhibited 1,1,1-Trichloroethane	—	colorless liquid	—	-38	73.4-85.7 ⁶	1.319	10.97	1.435	none	<0.1	∞	∞
DOWFUME® V Mixture of Carbon Tetrachloride, Ethylene Dichloride, and Ethylene Dibromide	—	clear, colorless to pale-yellow liquid	—	—	73.5-80 ³	1.555 (20/20°C.)	12.95 (20°C.)	—	none	ins.	∞	∞
Epichlorohydrin	$\text{OCH}_2\text{CHCH}_2\text{Cl}$	colorless liquid	92.5	-57.1 ²	115-117 ³	1.178	9.80	1.436	105	6	∞	∞
Ethyl Chloride, Technical⁹	$\text{CH}_3\text{CH}_2\text{Cl}$	colorless, volatile liquid	64.5	-139	12.2	0.922 (0/4°C.)	7.69 (0°C.)	1.378 (0°C.)	below 0	0.6 (20°C.)	37	∞
Ethylene Dichloride	$\text{CH}_2\text{ClCH}_2\text{Cl}$	colorless liquid	99.0	-35.7	83.5	1.250	10.39	1.443	60	0.87 (20°C.)	∞	∞
Methyl Chloride	CH_3Cl	colorless gas	50.5	-97.6	-23.7	—	—	—	—	sl. sol.	sol.	—
Methyl Chloroform, Technical	CH_3CCl_3	colorless liquid	133.4	-30.6	73-75 ⁶	1.333	11.08	1.435	none	<0.1	∞	∞
Methylene Chloride, Technical	CH_2Cl_2	colorless liquid	84.9	-97	39.8	1.320	10.98	1.421	none	2	∞	∞
Monochlorobenzene	$\text{C}_6\text{H}_5\text{Cl}$	colorless liquid	112.6	-45.6	131.7	1.105	9.19	1.522	105	<0.1	∞	∞
PARADOW® p-Dichlorobenzene	$\text{C}_6\text{H}_4\text{Cl}_2$	white to clear transparent crystals	147.0	53	174	1.248 (55/4°C.)	10.41 (55°C.)	1.529 (55°C.)	155	0.008	34	216
DOW-PER®⁷ Perchloroethylene	$\text{CCl}_2:\text{CCl}_2$	colorless liquid	165.8	-22.4	121.0	1.619	13.47	1.503	none	<0.1	∞	∞
Propylene Dichloride	$\text{CH}_2\text{ClCHClCH}_3$	colorless liquid	113.0	-100	96.4 ²	1.156	9.61	1.437	60	0.27 (20°C.)	∞	∞
1,2,4-Trichlorobenzene	$\text{C}_6\text{H}_3\text{Cl}_3$	colorless liquid	181.5	16.5	213.5-214.0 ³	1.454	12.10	1.569	260	<0.1	∞	∞
1,1,2-Trichloroethane	$\text{CH}_2\text{ClCHCl}_2$	colorless liquid	133.4	-36.6	113.8 ²	1.4319	11.94	1.4687	none	ins.	∞	∞
Trichloroethylene⁸	$\text{CCl}_2:\text{CHCl}$	colorless liquid	131.4	-86.8 ²	87.1 ²	1.459	12.14	1.474	none	<0.1	∞	∞
1,2,3-Trichloropropene (Mixed isomers)	$\text{CHCl:CClCH}_2\text{Cl}$	amber liquid	145.4	-78	138-151 ³	1.416	11.75	1.4981	none	ins.	∞	∞
Vinylidene Chloride	$\text{CH}_2:\text{CCl}_2$	colorless liquid	96.95	-122.0	31.6	1.218 (20/4°C.)	10.15	1.427 (20°C.)	15	0.55 (20°C.)	∞	∞

¹ Also available as Carbon Tetrachloride, A.C.S. and Carbon Tetrachloride X

² Pure compound

³ Boiling range, 5-95%

⁴ Also available in N.F. grade

⁵ Also available in technical grade

⁶ Boiling range IBP-DP

⁷ Also available as perchloroethylene, industrial

⁸ Available in five grades for specific industrial applications under the registered trademarks ALK-TRI, NEU-TRI, HI-TRI and EX-TRI and as technical grade

⁹ Also available in U.S.P. grade

nitrogen compounds

Nitrogen compounds are employed as intermediates in the manufacture of resins, coatings, adhesives, pharmaceuticals, agricultural chemicals, textile chemicals, dyes and pigments, explosives, rubber accelerators, sequestering agents, wetting agents, and ion exchange resins. They also find application as solvents, corrosion inhibitors, paper chemicals, fire retardants, emulsifiers, and catalysts, and in gas purification. Many of the amines find application in the production of polishes, metal-cleaning mixtures, shampoos and shaving creams, and detergents and emulsifying agents.

Ammonia is used as a refrigeration medium and a source of nitrogen and hydrogen for hydrogenation of olefins and heat

treatment of metals. Huge quantities are used as fertilizer and additional quantities in the manufacture of rayon, cellulose nitrate, nylon, melamine, and the resin intermediates acrylonitrile and cyanohydrin. Ammonia is also utilized in the production of nitric acid, soda ash, ammonium salts, cyanides, and explosives, and in ink, fluxes, wood preservatives, and fireproofing compounds.

Methionine is an amino acid which is utilized as a dietary supplement in animal nutrition. In addition, methionine is effective as a medicinal in the treatment of various liver disorders.

properties

PRODUCT	FORMULA	Description	Molecular weight	Freezing point °C.	Boiling point °C. 760 mm. Hg	Specific gravity 25/25°C.	Lb./gal. at 25°C.	Refractive index at 25°C.	Flash point °F.	Approx. sol. g./100g. solvent at 25°C.		
										water	methanol	ether
Aminoethylethanolamine	$\text{HOC}_2\text{H}_4\text{NHC}_2\text{H}_4\text{NH}_2$	colorless liquid	104.2	—	243-245 ²	1.028	8.55	1.484	270	∞	∞	<0.1
Ammonia, Anhydrous, Refrigeration Grade	NH_3	colorless gas	17.03	-77.7	-33.35	0.6819 ⁴	—	—	—	v.sol.	sol.	sol.
Ammonia, Anhydrous, Technical Grade ³	NH_3	colorless gas	17.03	-77.7	-33.35	0.6819 ⁴	—	—	—	v.sol.	sol.	sol.
Ammonia, Aqua, 26° Baumé	NH_4OH	colorless liquid	35.05	—	—	0.897 (60/60°F.)	7.48 (60°F.)	—	—	∞	—	—
Aniline	$\text{C}_6\text{H}_5\text{NH}_2$	colorless liquid	93.1	-6.0 ⁵	184.0 ⁵	1.021	8.50	1.583	190	4	∞	∞
Diethanolamine	$(\text{HOC}_2\text{H}_4)_2\text{NH}$	colorless liquid	105.1	27.5	168-169 at 20 mm. Hg ²	1.088 (30/4°C.)	9.09 (30°C.)	1.475 (30°C.)	300	∞	∞	0.75
Diethylenetriamine	$(\text{NH}_2\text{C}_2\text{H}_4)_3\text{NH}$	colorless to light-amber liquid	103.2	-35	199-209 ²	0.950	7.91	1.483	210	∞	∞	∞
Diisopropanolamine	$(\text{CH}_3\text{CHOHCH}_2)_2\text{NH}$	white to slightly yellow crystalline solid	133.2	39	119-123 at 5 mm. Hg	0.992 (40/4°C.)	8.28 (40°C.)	1.4485 (60°C.)	280	∞	∞	∞
Ethylenediamine, 98%	$\text{NH}_2\text{C}_2\text{H}_4\text{NH}_2$	colorless liquid	60.1	11.0	117.0 ⁵	0.8955	7.46	1.455	100	∞	∞	∞
Methionine, N.F.	$\text{CH}_3\text{SC}_2\text{H}_4\text{CH}(\text{NH}_2)\text{COOH}$	fine, white crystals	149.2	—	—	—	—	—	—	3.5	<0.1	<0.1
p,p'-Methylenedianiline	$(\text{H}_2\text{NC}_6\text{H}_4)_2\text{CH}_2$	light tan solid	198.3	90.0	262-268 at 25mm. Hg	1.056 (100/4°C.)	—	—	430	0.14	143	9.5
3-Methyl-1-Phenyl-5-Pyrazolone	$\text{C}_6\text{H}_5\text{NN}:\text{C}(\text{CH}_3)\text{CH}_2\text{CO}$	white to slightly yellow powder	174.2	128.9 ¹	—	—	—	—	—	<0.1	17	1
Mixed Isopropanolamines	—	colorless liquid	—	-30 ⁶	—	1.006	8.37	1.461	255	∞	∞	∞
Monoethanolamine	$\text{HOC}_2\text{H}_4\text{NH}_2$	colorless liquid	61.1	10.3	170-172 ²	1.015	8.45	1.453	195	∞	∞	2.1
Monoisopropanolamine	$\text{CH}_3\text{CHOHCH}_2\text{NH}_2$	colorless liquid	75.1	-2	158-163 ²	0.960	7.99	1.445	165	∞	∞	∞
Morpholine	$\text{NHC}_2\text{H}_4\text{OC}_2\text{H}_4$	colorless liquid	87.1	-4.9	—	0.999	8.32	1.4545 (20°C.)	100	∞	∞	∞
OCPN® 2-Chloro-4-nitroaniline	$\text{C}_6\text{H}_3\text{ClNO}_2\text{NH}_2$	yellow, crystalline powder	172.6	107.0	—	—	—	—	—	<0.1	21	18
PCON® 4-Chloro-2-nitroaniline	$\text{C}_6\text{H}_3\text{ClNO}_2\text{NH}_2$	orange, crystalline powder	172.6	115.5	—	—	—	—	—	<0.1	12.6	16
Pentaethylenhexamine	$\text{NH}_2(\text{C}_2\text{H}_4\text{NH})_4\text{C}_2\text{H}_4\text{NH}_2$	reddish-brown liquid	232.3	-26 ⁷	178-254 ⁸ at 5mm. Hg	1.0059	8.39	—	365	—	∞	∞
Phenylhydrazine, 97%	$\text{C}_6\text{H}_5\text{NHNH}_2$	white to pale-yellow liquid	108.1	19.0	238.2-241.5 ²	1.097	9.13	1.607	190	9	∞	∞
Piperazine	$\text{NHC}_2\text{H}_4\text{NHC}_2\text{H}_4$	fine, white crystals	86.1	110	146	—	—	—	160	20	120	4
Tetraethylenepentamine	$\text{NH}_2(\text{C}_2\text{H}_4\text{NH})_3\text{C}_2\text{H}_4\text{NH}_2$	slightly viscous, light amber liquid	189.3	below -40 ⁷	—	0.992	8.26	1.503	310	∞	∞	∞
Triethanolamine	$(\text{HOC}_2\text{H}_4)_3\text{N}$	colorless liquid	142 ⁹	17.9	175-191 ² at 5mm. Hg	1.121	9.33	1.484	365	∞	∞	1.6
Triethanolamine, 98%	$(\text{HOC}_2\text{H}_4)_3\text{N}$	colorless liquid	142 ⁹	20.4	190-193 ² at 5mm. Hg	1.124	9.35	1.484	385	∞	∞	1.7
Triethylenetetramine	$\text{NH}_2(\text{C}_2\text{H}_4\text{NH})_2\text{C}_2\text{H}_4\text{NH}_2$	slightly viscous amber liquid	146.2	below -40 ⁷	260-290 ¹⁰	0.977	8.13	1.496	265	∞	∞	∞
Triisopropanolamine	$(\text{CH}_3\text{CHOHCH}_2)_3\text{N}$	white to light yellow waxy solid	191.3	60	300	1.010 (Density 40°C.)	8.44 (40°C.)	1.4600	325	∞	—	—

¹ Melting point² Boiling range, 5-95%³ Also available in refrigeration, fertilizer, and agricultural grades
⁴ Specific gravity of liquid at -33.4/4°C.⁵ Pure compound⁶ Sets to a glassy solid below this temperature⁷ Pour point⁸ Boiling range, 5-80%⁹ Apparent equivalent weight¹⁰ Boiling range 5%-DP

ethylenimine and ethylenimine derivatives

Ethylenimine and its derivatives are new Dow products which show actual or potential utility as creaseproofing, waterproofing, shrinkproofing and flameproofing compounds, dye and pigment binders, ingredients of printing inks and pastes, surfactants, ion exchange resins, varnish and lacquer compo-

nents, photographic chemicals, agricultural products, cosmetics and pharmaceuticals, polymer stabilizers, etc. Detailed information concerning the uses for the individual products is available upon request.

properties

PRODUCT	FORMULA	Description	Molec- ular weight	Freezing point °C.	Boiling point, °C. 760 mm. Hg	Density gm./cc. at 25°C.	Lb./gal. at 25°C.	Refractive index at 25°C.	Flash point °F.	Viscosity, cps. at 25°C.	Approx. sol. g./100 g. solvent at 25°C.		
											water	benzene	ethanol
Ethylenimine	$\text{CH}_2\text{CH}_2\text{NH}$	colorless liquid	43.07	-78	56	0.832	6.94	1.4123	12	0.418	∞	∞	∞
Bis(2-aminoethyl) Sulfide	$(\text{H}_2\text{NCH}_2\text{CH}_2)_2\text{S}$	colorless liquid	120.2	2.6	238	1.05 (20°C.)	8.7	1.5277	246	4.36	v. sol.	v. sol.	v. sol.
Mercaptoethylamine Hydrochloride	$\text{HSCH}_2\text{CH}_2\text{NH}_2 \cdot \text{HCl}$	white solid	113.6	70-71	—	—	—	—	—	—	v. sol.	sl. sol.	v. sol.
MONTREK* 600 Polyethylenimine	$(\text{CH}_2\text{CH}_2\text{NH})_x$	33% solution in water	40-60 $\times 10^3$	—	—	—	8.79	—	—	3500	∞	ins.	sol.
MONTREK 1000 Polyethylenimine	$(\text{CH}_2\text{CH}_2\text{NH})_x$	33% solution in water	50-100 $\times 10^3$	—	—	—	8.82	—	—	50,000	∞	ins.	sol.
MONTREK 6 Polyethylenimine	$(\text{CH}_2\text{CH}_2\text{NH})_x$	viscous liquid	600	—	—	—	8.60	—	—	2700	∞	ins.	sol.
MONTREK 12 Polyethylenimine	$(\text{CH}_2\text{CH}_2\text{NH})_x$	viscous liquid	1200	—	—	—	8.64	—	—	13,000	∞	ins.	sol.
MONTREK 18 Polyethylenimine	$(\text{CH}_2\text{CH}_2\text{NH})_x$	viscous liquid	1800	—	—	—	8.67	—	—	29,000	∞	ins.	sol.
Tris(1-aziridinyI) phosphine Oxide	$(\text{CH}_2\text{CH}_2\text{N})_3\text{PO}$	80% solution in acetone	173.2	43.5 (pure APO)	decomposes	1.09- 1.115 (30°C.)	9.2	—	26	—	∞	∞	v. sol.

salicylates

Salicylates find use medicinally as antipyretics, analgesics, antirheumatics, and antiseptics, and in the treatment of certain intestinal ailments and skin diseases. They are also employed as ingredients of mouth washes, toothpastes, gargles, and dental powders; as flavoring for candy and gum; and in

perfumes. Other uses for salicylates are as ultraviolet light absorbers, preservatives, retarders in vulcanizing rubber, ingredients in fly sprays and penetrating oils, and intermediates in the manufacture of dyestuffs, pharmaceuticals, and photographic chemicals.

properties

PRODUCT	FORMULA	Description	Mole- cular weight	Freezing point °C.	Boiling point °C. 760 mm. Hg	Sp. gr. 25/25°C.	Lb./gal. at 25°C.	Refractive index at 25°C.	Flash point °F.	Approx. sol. g./100g. solvent at 25°C.		
										water	alcohol	ether
Acetylsalicylic Acid, U.S.P. ¹	$\text{C}_6\text{H}_4(\text{OOCCH}_3)\text{COOH}$	white, crystalline powder	180.2	—	—	—	—	—	—	0.3	25	12
Methyl Salicylate, U.S.P.	$\text{HOC}_6\text{H}_4\text{COOCH}_3$	colorless liquid	152.1	-1.2 ²	221.6	1.182	9.84	—	230	0.14	∞	∞
Salicylaldehyde	$\text{HOC}_6\text{H}_4\text{CHO}$	straw-colored liquid	122.1	1.5	195.5	1.163	9.68	1.571	170	s.s.	sol.	∞
Salicylic Acid, U.S.P. ³	$\text{HOC}_6\text{H}_4\text{COOH}$	clear, needle-like crystals or white, crystalline powder	138.1	158.9 ⁴	76 ⁵	—	—	—	—	0.2	64 methanol	40
Salol	$\text{HOC}_6\text{H}_4\text{COOC}_6\text{H}_5$	fine, white crystals	214.2	41.8 ⁴	—	—	—	—	—	<0.1	53	635
Sodium Salicylate, U.S.P.	$\text{HOC}_6\text{H}_4\text{COONa}$	white, crystalline powder	160.1	—	—	—	—	—	—	113	26	<0.1
TBS 4-tert-Butyl Phenylsalicylate	$\text{C}_6\text{H}_4\text{OHCOOC}_6\text{H}_4\text{C}(\text{CH}_3)_3$	off-white crystals	270.3	62-64 ⁴	—	—	—	—	—	<0.1	79	—

¹ Also available as U.S.P. powder and granulations with starch

² Crystallizes in two forms

³ Also available in technical and crude grades

⁴ Melting point

⁵ Sublimation point

*Trademark

diphenyl oxide and derivatives

Diphenyl oxide is utilized as a component in heat transfer media and in the manufacture of synthetic perfumes, particularly rose and geranium fragrances. The diphenyl oxide

derivatives show potential utility as chemical intermediates, resins, varnish ingredients, catalysts, curing agents, and plasticizers for various systems.

properties

PRODUCT	FORMULA	Description	Molecular weight	Melting point °C.	Boiling point °C. 760 mm. Hg	Specific gravity 25/25°C.	Lb./gal. at 25°C.	Refractive index at 25°C.	Flash point °F.	Approx. sol. g./100 g. solvent at 25°C.		
										water	ethanol	ether
Diphenyl Oxide¹	$\text{C}_6\text{H}_5\text{OC}_6\text{H}_5$	colorless liquid	170.2	27 ²	257	1.070 (27/4°C.)	8.92 (27°C.)	1.579	205	ins.	∞	∞
CMDPO-17 Chloromethylated Diphenyl Oxide-17	$\text{C}_6\text{H}_5\text{OC}_6\text{H}_4-(\text{CH}_2\text{Cl})_{\sim 1}$	straw to light yellow-colored liquid	222 average	—	—	1.19	9.90	1.596	307	0.018	—	∞
CMDPO-25 Chloromethylated Diphenyl Oxide-25	$(\text{ClCH}_2)_{\sim 1}-\text{C}_6\text{H}_4\text{OC}_6\text{H}_4-(\text{CH}_2\text{Cl})_{\sim 1}$	white semi-solid	260 average	50-55 ³	—	1.26	10.48	1.60	—	0.002	—	392
CMDPO-32 Chloromethylated Diphenyl Oxide-32	$(\text{ClCH}_2)_{\sim 1}-\text{C}_6\text{H}_4\text{OC}_6\text{H}_3-(\text{CH}_2\text{Cl})_{\sim 2}$	straw to yellow-colored liquid	304 average	43 ³	—	1.30	10.82	1.6	—	0.008	—	∞
Diphenyl Oxide-Modified Novolacs	Resinous	light amber solid	480 average	55-60 ⁴	—	1.11	9.24	—	603	0.006	285	287
	Resinous	light amber solid	850 average	77-80 ⁴	—	1.22	10.15	—	605	0.029	215	201
	Resinous	light amber solid	1300 average	96-115 ⁴	—	1.23	10.23	—	605	0.022	26.7	13.7
Diphenyl Oxide-Modified tert-Butyl-phenol Resin	Resinous	light amber solid	1600 average	05-115 ⁴	—	1.14	9.49	—	563	0.03	16.4	185
MMDPO-15 Methoxymethyl Diphenyl Oxide-15	$\text{C}_6\text{H}_5\text{OC}_6\text{H}_4-(\text{CH}_2\text{OCH}_3)_{\sim 1}$	pale yellow liquid	—	—	—	1.10	9.15	1.570	291	<0.01	∞	∞
MMDPO-22 Methoxymethyl Diphenyl Oxide-22	$(\text{CH}_3\text{OCH}_2)_{\sim 1}-\text{C}_6\text{H}_4\text{OC}_6\text{H}_4-(\text{CH}_2\text{OCH}_3)_{\sim 1}$	pale yellow liquid	—	—	—	1.11	9.24	1.559	372	0.03	∞	∞

¹ Available in perfume and technical grades

² Freezing point

³ Completely melted

⁴ Softening point

miscellaneous organic compounds

These compounds are utilized by industry in a great variety of ways. They are employed as solvents and solvent-diluents for nitrocellulose, rubber, varnishes, shellacs, resins, waxes, printing inks, and other materials. They are also used as chemical intermediates in the synthesis of adhesives, agricultural chemicals, lubricating oils and additives, ore flotation

agents, and plasticizers, and as homogenizers and stabilizers in soap manufacturing, textile finishing, and dry cleaning. Other applications are in the manufacture of pharmaceutical and synthetic perfumes, and as flavoring materials, fire retardants, plasticizers, gasoline antiknock agents, disinfectants, and resin monomers and crosslinking agents.

properties

PRODUCT	FORMULA	Description	Molecular weight	Freezing point °C.	Boiling point °C. 760 mm. Hg	Specific gravity 25/25°C.	Lb./gal. at 25°C.	Refractive index at 25°C.	Flash point °F.	Approx. sol. g./100g. solvent at 25°C.		
										water	methanol	ether
Allyl Alcohol	$\text{CH}_2=\text{CHCH}_2\text{OH}$	colorless liquid	58.1	-129	96-98 ¹	0.850	7.07	1.411	54	∞	∞	∞
Butanol	$\text{CH}_3(\text{CH}_2)_3\text{OH}$	colorless liquid	74.1	-89.8	117.8	0.805 (25/4°C.)	6.72	1.3971	110	7.4	∞	∞
Butanol Solvent No. 1	—	colorless liquid	—	-92.2	116.3	0.805 (25/4°C.)	6.72	1.3970	105	7.5	∞	∞
Isobutanol	$\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{OH}$	colorless liquid	74.1	-108.0	108.0	0.7977 (25/4°C.)	6.66	1.3936	95	8.7	∞	∞
Diethylbenzene	$\text{C}_6\text{H}_4(\text{C}_2\text{H}_5)_2$	colorless liquid	134.2	below -70	180-182 ²	0.870 (60/60°F.)	7.25 (60°F.)	1.493	135	ins.	∞	∞
Diisopropylbenzene ³	$\text{C}_6\text{H}_4(\text{CH}_2\text{CHCH}_3)_2$	colorless liquid	162.3	below -50	202-209 ²	0.865	7.20	1.490	170	ins.	∞	∞
1,4-Dioxane	$(\text{CH}_2\text{CH}_2\text{O})_2$	colorless liquid	88.1	11.6	101.0-102.5 ²	1.030	8.56	1.4200	50	∞	∞	∞
Divinylbenzene 55% ⁴	—	colorless to pale, straw-colored liquid	—	-87 ⁵	195	0.918	7.64	1.561	165	.027	∞	∞
Ethylbenzene	$\text{C}_6\text{H}_5\text{C}_2\text{H}_5$	colorless liquid	106.2	-95.0	136.2	0.865	7.20	1.493	90	<0.1	∞	∞
Ethylene Carbonate	$\text{CO}(\text{CH}_2\text{O})_2$	white solid	88.1	36	—	1.322 (40/4°C.)	11.03 (40°C.)	1.4158 (50°C.)	305	>100 ⁶	>100 ⁶	10 ⁶
Propylene Carbonate	$\text{C}_3\text{H}_5\text{O}_2$	colorless liquid	102.1	-54.7 ⁷	240	1.199 (25/4°C.)	9.97	1.4216 (20°C.)	270	22	∞	∞
p-Hydroxybenzaldehyde	$\text{C}_6\text{H}_4\text{OHCHO}$	pink powder	122.1	116.5 ⁷	—	—	—	—	—	1.0	116	12
Isopropylbenzene	$\text{C}_6\text{H}_5\text{CH}_2\text{CHCH}_3$	colorless liquid	120.2	-96	152.4	0.859	7.15	1.488	110	ins.	∞	∞
α-Methyl Styrene	$\text{C}_6\text{H}_5\text{C}(\text{CH}_3):\text{CH}_2$	colorless liquid	118.2	-23.1	165	0.9078	7.55	1.5360	140	<0.1	—	—
Styrene	$\text{C}_6\text{H}_5\text{CH}:\text{CH}_2$	colorless liquid	104.1	-30.6	145.2	0.9045	7.53	1.544	85	<0.1	∞	∞
Vinyltoluene	$\text{C}_6\text{H}_4\text{CH}_3\text{CH}:\text{CH}_2$	colorless liquid	118.2	-76.8	170-172	0.890	7.41	1.534 (35°C.)	140	<0.1	∞	∞

¹ BP. — DP

² Boiling range, 5-95%

³ Isomeric mixture with a guaranteed 90% minimum diisopropylbenzenes

⁴ Mixture of divinylbenzene and ethylvinylbenzene; also available as 22% divinylbenzene

⁵ Solidifies

⁶ At 39°C.

⁷ Melting point

halogens

Chlorine is one of the most important chemical raw materials. Large quantities are used in purifying water and preventing the growth of algae in water storage tanks. Other major uses include production of chlorinated aliphatic and aromatic compounds, rubber chemicals, stabilizers and inhibitors, intermediates for organic synthesis, and commercial and household bleaches. It is likewise utilized in bleaching wood pulp and mercerizing, bleaching, dyeing, and printing textiles.

Bromine is an oxidizing and brominating agent. It is employed

in the manufacture of lachrymators, brominated dyes, and bromides for medicinal, photographic, and industrial uses. Further information concerning the use of bromine and its compounds is presented on pages 11 and 20.

Iodine finds extensive application as a medicinal in the form of tincture of iodine and various organic and inorganic derivatives; in the manufacture of iodides, iodates, dyes, and intermediates; and as an analytical reagent.

properties

PRODUCT	FORMULA	Description	Molecular weight	Freezing point °C.	Boiling point °C. 760mm. Hg	Specific gravity 25/25°C.	Lb./gal. at 25°C.	Approx. sol. g./100g. solvent at 25°C.		
								water	methanol	ether
Chlorine	Cl ₂	greenish-yellow gas	70.9	-101	-34.1	—	—	0.65	—	—
Bromine, Purified	Br ₂	reddish-brown fuming liquid	159.8	-7.2	58.8	3.102 (25/4°C.)	26.01 (20°C.)	3.5	∞	∞
Iodine	I ₂	purplish-black lumps or granules	253.8	114.1 ¹	184.3 sublimates	—	—	0.03	23	24

¹ Melting point

alkalies

Caustic soda has such great importance as an industrial chemical that the tonnage produced each year serves as an accurate economic barometer for the chemical industry. Industrial operations and processes utilizing caustic soda include degreasing metal, de-inking waste paper, dyeing and finishing cotton textiles, production of wood pulp, manufacture of rayon, manufacture of soaps and detergents, production and purification of organic and inorganic chemicals, refining of animal and vegetable oils, refining of petroleum, rubber reclamation, purification of dry-cleaning solvents, production of phosphate fertilizers, production of alumina from bauxite, and a host of others. It is the active ingredient in lye, drain cleaners, cleaning and bottle-washing compounds, and boiler compounds.

Caustic potash has many of the same applications as caustic soda. Additional important uses include the manufacture of pharmaceutical and veterinary medicines and photographic chemicals.

Like caustic soda, soda ash is a primary industrial chemical. Great quantities are used in manufacturing glass, soap, cleaning compounds, water softeners, textiles, paper, and other chemicals and in the refining of petroleum. Miscellaneous applications include the preparation of abrasives, adhesives, cattle feed, and fertilizers.

Sodium orthosilicate is used as a heavy-duty detergent for metal cleaning, as a soap builder in detergents for laundries, and as an ingredient in various alkali mixtures.

properties

PRODUCT	FORMULA	Description	Molecular weight	Freezing point °C.	Boiling point °C. 760mm. Hg	Sp. gr. 25/25°C.	Lb./gal. at 25°C.	Approx. sol. g./100g. solvent at 25°C.		
								water 25°C.	water 80°C.	alcohol
Caustic Potash ¹ (West Coast only)	KOH	white, deliquescent solid or flakes	56.1	400 ²	—	—	—	sol.	sol.	sol.
Caustic Potash Solution (50%) (West Coast only)	KOH	colorless liquid	56.1	9	145	1.512 (20/4°C.)	12.6 ³ (20°C.)	∞	∞	sol.
Caustic Soda ¹	NaOH	white, deliquescent solid or flakes	40.0	318 ²	—	—	—	114	313	15
Caustic Soda Solution (73%)	NaOH	colorless liquid	40.0	68	198	1.700 ³ (100°C.)	14.2 ³ (100°C.)	∞	∞	sol.
Caustic Soda Solution (50%)	NaOH	colorless liquid	40.0	13	144	1.525 ³ (20°C.)	12.7 ³ (20°C.)	∞	∞	sol.
Soda Ash 58% Light	Na ₂ CO ₃	fine white crystals	106.0	—	—	—	—	29.4	sol.	ins.
Sodium Orthosilicate	Na ₄ SiO ₄	white ground flake	184.06	—	—	—	—	sol.	sol.	sol.

¹ Available in two or more forms

² Melting point

³ Approximate

inorganic magnesium compounds

Epsom salt enjoys extensive application in a variety of industrial processes. It is a delustrant for rayon, a reagent in leather tanning, a mordant assist in textile dyeing and printing, and an ingredient of paper sizing. In addition, it is a constituent of magnesium oxychloride and magnesium oxysulfate cements, finds use as a medicinal and is used for various purposes in the ceramic, explosives, match, and fertilizer industries.

Magnesium oxide (Magnesite) is used in the manufacture of 85 percent magnesia insulation, fertilizers, and oxychloride and oxysulfate cements; in rayon textile processing, water treating,

and the production of sulfite pulp; and as an alkali. It is an intermediate in the production of pharmaceuticals and an anticaking agent in powdered cleansers. A special grade of magnesium oxide, designated "Magnesia, Oxychloride grade," and meeting ASTM C275-56T, is used in oxychloride and oxysulfate cements.

Magnesium hydroxide is used in the production of sulfite pulp, as a residual fuel-oil additive, in uranium processing, as a chemical intermediate and as an alkali.

properties

PRODUCT	FORMULA	Description	Molecular weight	Freezing point °C.	Boiling point °C. 760 mm. Hg	Specific gravity 25/25°C.	Lb./gal. at 25°C.	Approx. sol. g./100g. solvent at 25°C.		
								water	alcohol	ether
Epsom Salt ¹ (Magnesium Sulfate)	MgSO ₄ ·7H ₂ O	colorless, needle-like crystals	246.5	—	—	—	—	72.4 (0°C.)	sl. sol.	—
Magnesium Oxide ²	MgO	white powder or granules	40.3	—	—	—	—	—	—	—
Magnesium Hydroxide Tech—100	Mg(OH) ₂	white powder	58.3	—	—	—	—	—	—	—
Magnesium Hydroxide Tech—60D	Mg(OH) ₂	slurry	58.3	—	—	1.53	12.8	—	—	—

¹ Available in U.S.P. and technical grades

² Available in several commercial grades

inorganic acids and acid gases

Hydrobromic acid finds application in medicine for the treatment of nervous conditions; in photographic bromide processes; in the synthesis of dyes, drugs, perfumes, and chemical intermediates; and in the manufacture of some bromides.

Muriatic acid is widely used industrially for hydrolyzing starch and proteins in the production of various food products, neutralizing basic systems, pickling and cleaning metals, chlorinating rubber, refining tin and tantalum ores, and acidiz-

ing oil and gas wells, as well as in many other applications. Large quantities also go into the production of metallic and organic chlorides and the preparation of pharmaceutical hydrochlorides.

Sulfur dioxide is a neutralizer, reducing agent, and acidifier. It is used as a selective solvent in petroleum refining, as a protective atmosphere in magnesium casting, and as a bleach, antichlor, fumigant, and preservative.

properties

PRODUCT	FORMULA	Description	Molecular weight	Freezing point °C.	Boiling point °C. 760 mm. Hg	Specific gravity 25/25°C.	Lb./gal. at 25°C.	Solubility at 25° C.		
								water	alcohol	ether
Hydrobromic Acid, 48% ¹	HBr	colorless to pale yellow fuming solution	80.9	—63	124 738 mm. Hg	1.487	12.5 (20°C.)	∞	sol.	—
Hydrobromic Acid, 62%	HBr	pale yellow fuming solution	80.9	—	—	1.723	14.3	∞	sol.	—
Hydrogen Bromide, Anhydrous	HBr	colorless gas which fumes strongly in moist air	80.9	—	—67	—	—	v.sol.	sol.	—
Muriatic Acid ²	HCl	colorless to very slightly yellow, fuming liquid	36.5	—	—	—	—	∞	—	—
Hydrogen Chloride, Anhydrous	HCl	colorless gas which fumes strongly in moist air	36.5	—	—85	—	—	v.sol.	sol.	sol.
Sulfur Dioxide	SO ₂	colorless gas	64.1	—75.5	—10	1.363 (80/80°F.)	—	sol.	sol.	—

¹ Also available in medicinal grade

² Available in several strengths

inorganic chlorides

Calcium chloride is of value principally because of its hygroscopic and deliquescent properties and because its water solutions have extremely low freezing points. It attracts and holds moisture; it is useful in controlling dust on unpaved roads, streets and parking areas. It is also useful in providing uniform moisture content in the stabilization of granular soils. The ability of calcium chloride to lower the freezing point of water makes it effective in providing bare pavement maintenance in highway ice control and in freezeproofing abrasives used to skidproof icy roads. Its inherent chemical characteristics impart utility as an admixture in concrete to accelerate the set of the cement and provide high early strength.

In water solution it is utilized as a refrigerating medium in artificial ice plants and cold storage systems, as a non-freezing ballast in tractor tires, and as an antifreeze solution in fire-fighting equipment and installations. It finds further use as an acceleration and curing agent for portland cement concrete, and in freezeproofing coal and ore, dehydrating oils and solvents, and drying air and gases. Calcium chloride also finds application as an ingredient in fire-proof paints, sizing compounds, weed killers, and textile softeners, and is used in the cement and paper industries. Miscellaneous uses include

oil well completion fluids and the preservation of natural leaves and foliage for decorative purposes.

Ferric chloride is used as an ingredient in photoengraving and etching solutions, as a coagulant and conditioning agent for sewage, and as a mordant in dyeing. It also goes into the preparation of medicinals containing iron, the manufacture of pigments and dyes, and the synthesis of fine organic chemicals.

Ferrous chloride is employed as a mordant in textile dyeing and printing and a reducing agent in the manufacture of dye-stuffs. Further applications include the purification of acetylene, metallurgy and electroplating, and the production of powdered iron.

Large quantities of magnesium chloride are consumed as cell feed in the electrolytic production of magnesium metal and additional amounts as a magnesium flux.

Magnesium chloride is used as the gauging solution in the production of magnesium oxychloride cements, as a flocculating agent, and as a catalyst in certain organic reactions, as well as in the production of magnesium compounds and the treatment of foliage for fire resistance and prevention of drying.

properties

PRODUCT	FORMULA	Description	Molecular weight	Melting point °C.	Sp. gr. 25/25°C.	Lb./gal. at 25°C.	Approx. sol. g./100g. solvent at 25°C.	
							water	alcohol
Calcium Chloride, 73-75%¹	CaCl ₂	white, deliquescent lumps or solid	110.99	—	—	—	95	15
Calcium Chloride, Anhydrous 94-97%¹	CaCl ₂	white, deliquescent flakes, lumps or powder	110.99	—	—	—	105	20
DOWFLAKE® calcium chloride, 77-80%¹	CaCl ₂	white, deliquescent flakes	110.99	—	—	—	140	25
PELADOW® calcium chloride, 94-97%¹	CaCl ₂	white, deliquescent pellets	110.99	—	—	—	sol.	sol.
Calcium Chloride Liquor	—	colorless liquid	—	—	—	—	∞	sol.
LIQUIDOW* calcium-magnesium chloride liquor²	—	colorless to pale yellow liquid	—	—	—	—	∞	—
Ferric Chloride Solution³	—	reddish-brown water solution	—	—	—	—	∞	—
Ferrous Chloride Solution, 40° Bé	—	greenish-yellow liquid	—	—	1.381 (60/60°F.)	11.51 (60°F.)	∞	—
Magnesium Chloride, Anhydrous	MgCl ₂	white or gray flakes or powder	95.2	712	2.18	—	57	sol.
Magnesium Chloride Flake	MgCl ₂ ·6H ₂ O	thin, white flakes	203.2	118 with decomposition	1.56	—	609	50

¹ Available in two or more forms

² Available in 32%, 35% and 38% solutions

³ Available in several commercial grades

* Trademark

inorganic fluorine, bromine and iodine compounds

Bromides are utilized in photography, process engraving and lithography, textile printing and dyeing, oil refining, organic synthesis, and the manufacture of pharmaceuticals. Several also find use medicinally as sedatives and in the treatment of nervous conditions.

Potassium and sodium bromate are used as neutralizers in permanent wave solutions and as oxidizing agents. They also show utility for the generation of bromine. Potassium bromate finds additional application in dough-improver formulations used in the milling and baking industries, and as an analytical reagent.

Potassium iodide, U. S. P. is utilized as a catalyst, analytical and process reagent, and pharmaceutical chemical; in sanitation and dye manufacture; and in the preparation of animal feeds, mineral mixes, and iodized salt for human and animal nutrition.

Titanium tetraiodide is employed as a catalyst.

The major use for fluorspar is in making hydrofluoric acid. It is also employed as a fluxing agent in aluminum and magnesium cells.

properties

PRODUCT	FORMULA	Description	Molecular weight	Approx. sol. g./100g. solvent at 25°C.	
				water	alcohol
Ammonium Bromide, N.F.	NH ₄ Br	colorless crystals or white granules	98.0	79	10 (78°C.)
Cadmium Bromide	CdBr ₂	white powder	272.2	121 (10°C.)	sol.
Fluorspar, Acid Grade, 97.0%	CaF ₂	gray powder	78.08	0.0016	sl. sol.
Phosphorus Tribromide	PBr ₃	pale yellow, fuming liquid	270.7	decomposes	decomposes
Potassium Bromate	KBrO ₃	white granules or powder	167.0	8	sl. sol.
Potassium Bromate (with 5% MgCO ₃)	—	white powder	—	—	—
Potassium Bromide, N.F.	KBr	colorless or white granules	119.0	68	9 (30°C.)
Potassium Iodide, U.S.P.	KI	white crystals	166.0	sol.	sol.
Sodium Bromate	NaBrO ₃	white or slightly yellow granules	150.9	37.4	ins.
Sodium Bromide, N.F.	NaBr	colorless or white crystals	102.9	94	7 (16°C.)
Titanium Tetraiodide	TiI ₄	reddish-black powder	555.6	decomposes	—

PAINT PRODUCTS

Dow sells monomers, latexes, resins, resin intermediates, paint additives, paint remover ingredients, and processing aids to the paint industry.

Monomers, latexes, and resins are discussed in detail under "Coatings Products," pages 33-35, and the physical properties of the monomers are given on pages 12 and 16.

Resin Intermediates. Dow produces intermediates for alkyd, polyester, phenolic, epoxy, and urethane coatings.

Specific products utilized as intermediates include glycerine, ethylene glycols, propylene glycols, polyethylene glycols, polypropylene glycols, allyl alcohol, ethanolamine, butanol, isobutanol, phenol, Bisphenol A, p-tert-butylphenol, p-phenylphenol, p,p'-methylenedianiline, and ethylenediamine and its homologs. The newest group of Dow resin intermediates, the CMDPO products, are used as intermediates for resins that display high chemical resistance, heat resistance and weatherability.

Paint Additives. These include DOWANOL glycol ether solvents, chlorinated aliphatic hydrocarbon solvents, METHOCCEL® methylcellulose thickeners and protective colloids, DOWICIDE preservatives, BENAX® 2A1 and DOWFAX® 9N surfactants, polyglycol P1200 defoamer, ammonium hydroxide and monoethanolamine pH adjusters, and glycol leveling aids, hygroscopic agents and freeze-thaw stabilizers. Newest paint additive products include DALPAD® A coalescing agent, a stable, low-odor, low-temperature film-forming aid for polyvinyl acetate and acrylic latexes; DOWICIL 100 preservative, a non-phenolic product used as a package preservative in styrene-butadiene, acrylic, and polyvinyl acetate latex paints; and DOWANOL EEA solvent, a high-boiling, slow-evaporating material for use with cellulosic, acrylic, and epoxy resins.

Paint Remover Ingredients. Dow offers numerous products having utility in organic type paint removers. These include: active solvents—methylene chloride and DOWANOL glycol ethers; activators—ammonium hydroxide, ethanolamines, and chloroacetic acid; active diluents—ethylene dichloride, propylene dichloride, dichloroethyl ether, dichloroisopropyl ether, and o-dichlorobenzene; viscosity control aids—METHOCCEL products; evaporation retardant—ethylene glycol; corrosion inhibitors—propylene oxide and butylene oxide; and DOWFAX 9N9 surfactant.

Inorganic paint remover ingredients include: active ingredient—caustic soda; activators—sodium orthosilicate, polyol PS, and dipropylene glycol; and BENAX 2A1 surfactant.

Processing Aid. DOWTHERM® A heat-transfer agent provides easily controlled heat for cooking varnishes, oils and resins.

The properties of these products are presented in various sections of this catalog and product bulletins are available upon request.

SOLVENTS AND CLEANING CHEMICALS

DOW-PER perchloroethylene is designed specifically for the drycleaning industry. A companion product, DOW-PER Charger, is a fabric conditioner and detergent designed especially for use with DOW-PER solvent, but is compatible with all synthetic drycleaning solvents. It effectively removes organic-insoluble, water-soluble soils and is characterized by absence of odor.

NORG-CLOR 811 solvent is a Dow-developed "charged" drycleaning fluid which requires no detergent con-

centrate addition. The use of this fluid insures outstanding garment appearance and eliminates the need for test kits, sweetener powders, etc.

CHLOROTHENE NU and **CHLOROTHENE**, industrial inhibited 1,1,1-trichloroethane are widely accepted as nonflammable, low toxicity, economical solvents for cleaning of metal parts. They are normally used in spray, dip, wipe and flush applications at room temperature, but in certain applications are highly effective vapor degreasing solvents. The solvents are also widely used in non-cleaning applications such as vapor pressure depressants for aerosols, carriers for adhesives, extraction solvents and spot removers.

DOWCLENE EC solvent is a specialized room temperature cleaning solvent with balanced evaporation and low toxicity. It is a highly effective spray cleaner for electrical equipment and general maintenance cleaning.

DOWCLENE WR solvent is a highly purified solvent designed for the precision cleaning of components under white room conditions. It is characterized by its low toxicity, nonflammability, balanced solvent activity, and evaporation rate. It can be utilized in spray, flush, dip, ultrasonic or vapor degreasing applications.

Trichloroethylene is a universal vapor degreasing solvent. It is available in four grades for specific industrial applications. **NEU-TRI®** and **ALK-TRI®** solvents are specifically stabilized for vapor degreasing. **HI-TRI®** solvent is for low residue flushing applications primarily in the aerospace industry, and **EX-TRI®** solvent for extraction uses.

Methylene chloride is widely used as a major ingredient in nonflammable paint strippers. It is also utilized as a vapor pressure depressant in aerosols, flushing solvent and blowing agent for the urethane industry, extraction solvent for the pharmaceutical and petroleum industries, and for the bonding of certain plastics. It is characterized by strong solvency, nonflammability, low toxicity and fast evaporation.

Chlorinated Solvents. Dow also produces perchloroethylene, industrial, primarily used as a vapor degreasing solvent, chemical intermediate and for the manufacture of blended safety solvents. Tetrachloroethylene, U. S. P. is available for use by the pharmaceutical industry. 1, 1, 2-Trichloroethane is a specialty solvent that has applications as a chemical intermediate and for extraction purposes. **DOWCLENE 10** liquid bottle washing compound is an alkaline-based, completely formulated product for use in the food industry.

TRANSPORTATION CHEMICALS

Ethylene Glycol Base Antifreeze. Dow is a major supplier of ethylene glycol base antifreeze formulations to automobile manufacturers and antifreeze marketing companies. The formulations are developed after extensive laboratory and field testing by the Automotive Chemicals Laboratory, and in many instances are produced to specifications established by the customer.

WEATHERSET® antifreeze and summer coolant. This ethylene glycol-based product is Dow's own brand of antifreeze which is marketed through automotive distributors to the automotive aftermarket.

WEATHERSET is non-foaming, transfers heat efficiently and protects the cooling system all year from rust and corrosion.

SENTINEL® antifreeze coolant is a high quality ethylene glycol-based product which provides excellent cooling system protection. This Dow label product is marketed primarily through the non-service channels of distribution to do-it-yourself consumers.

DOWTHERM* 209 truck and bus antifreeze, a methoxy propanol-based coolant, is designed to solve the problem of contamination which occurs due to leakage of ethylene glycol-based coolants into the crankcase. This problem, which is most prevalent in diesel-powered vehicles, has plagued the transportation industry for years.

While this product cannot prevent leakage, it can prevent the buildup of sludge and varnish usually encountered when glycol antifreeze leaks into the lubrication system of an engine. It also provides cooling system protection against freezing, rust and corrosion.

AMBIFAL® 100 viscosity index improvers are utilized in polymer-thickened multigrade engine oils and automatic transmission fluids. These products exhibit superior viscosity stability and chemical stability in the face of extreme mechanical shear and sustained high operating temperatures, can accommodate higher-viscosity-base oils than many other additives, and show a significant advantage in top ring groove filling and engine cleanliness. They are thermally stable up to 340°C.—nearly 100°C. above the upper limit for methacrylate improvers.

AMBIFAL 200 anti-stall gasoline additive is designed to prevent engine stalling due to carburetor icing. It functions by coating the carburetor surface and reducing the adhesive force of the ice crystals. There is also evidence that it alters the crystalline structure of the ice. **AMBIFAL 200** is superior in effectiveness to any other known anti-stall additive.

Brake Fluids. Dow manufactures a wide variety of heavy-duty hydraulic brake fluids for use by the automotive industry on the assembly line and for private label marketers. Fluids available from Dow comply with the SAE 70R1, SAE 70R3, and Federal VV-H-910 specifications. Of special note is a super high-boiling brake fluid for use in disc brakes. This product, MD-50-4, meets a minimum boiling point of 550°F.

Jet Fuel Additive is incorporated into jet fuels to prevent in-flight formation of ice in fuel system parts. It is compatible with all of the materials of construction in the system, is stable in storage, and does not pose any unusual handling hazards. The product complies with current military specification MIL-I-27686-C (USAF), Inhibitor, Anti-Icing, Fuel Soluble.

Dow De-Icing Fluid No. 146 is a glycol formulation used for deicing and defrosting the wings and fuselages of stationary aircraft. The product has a high flash point, making it especially safe and even permitting it to be used in hot spray applications. It is essentially non-corrosive, and therefore does not attack metals normally found on aircraft. The product may be used to prevent the accumulation of frost and of ice caused by freezing rain, as well as to remove frost and ice after they have formed.

DOWFAX 9N5 surfactant, when added to gasoline, reduces stalling due to icing of the carburetor. This material enables refiners to produce a fuel with higher volatility, and hence with better cold weather starting characteristics.

Rubber Lubricant RL684. This product is a polyoxyalkylene glycol formulation designed primarily as a lubricant for mounting tires. Other applications are as a rubber dressing and a lubricant for installing rubber backings and washers. Desirable properties include good water and alcohol solubility, low toxicity, inertness to rubber, and non-corrosivity.

Polyglycol Filter Wettants are polyglycol formulations that increase the dust-gathering efficiency and capacity of automobile air filters. These products exhibit thixotropicity and oxidative stability, are non-hygroscopic, and have higher flash points than competitive materials.

HEAT-TRANSFER MEDIA

AMBITROL® industrial engine coolants have been developed for use in stationary industrial engines, particularly those employed in compressor stations or pipelines. A completely formulated product, **AMBITROL FL FULL-FILL®** coolant provides freeze protection for industrial engine cooling systems to -40°F., and protection against overheating. The inhibitor system in **AMBITROL FL** offers maximum protection from rust and corrosion.

AMBITROL CN freeze depressant concentrate is based on ethylene glycol and contains a scientifically blended inhibitor system to make it possible to be used with the many varieties of water found throughout the United States.

When the inhibitors of **AMBITROL** industrial engine coolants become depleted, they can be replenished by **AMBITROL** inhibitor. This product is a two-phase solution designed specifically for reinhibiting **AMBITROL FL** cooling system fluid and solutions of **AMBITROL CN** freeze depressant concentrate.

A unique analytical service is offered to users of the **AMBITROL** coolant whereby Dow periodically analyzes samples of **AMBITROL** from the cooling system and advises the user on the suitability of the coolant for further use. This service is available for systems that contain over 500 gallons of coolant.

DOWTHERM® A and **DOWTHERM E** heat-transfer media provide sources of high temperature, low pressure, easily controlled heat. These heat-transfer media are aromatic compounds that have unusually good thermal stability, relatively high specific heat, and excellent viscosity.

DOWTHERM A, which has an atmospheric boiling point of 495.8°F., is used in either liquid or vapor phase at temperatures up to 750°F., where its vapor pressure is only 144 psig. **DOWTHERM E**, with an atmospheric boiling point of 352°F., fulfills the need for vapor phase heating between high pressure steam and **DOWTHERM A**.

Typical uses for these two products are in processing nylon and other melt spun fibers, molding plastic and rubber products, processing paints and varnishes, processing food products, fractionating petroleum, heating chemical process equipment, heating rotating drums and coating coils, and evaporating high boiling materials.

In addition, **DOWTHERM A** and **DOWTHERM E** are often used for cooling—for example, in exothermic reactions or in situations where the product must be cooled after heating. The products can remove heat by sensible or latent heat effects.

DOWTHERM SR-1 heat-transfer medium is a specially inhibited ethylene glycol. It is utilized in snow removal systems, air conditioning equipment, ice skating rinks, in defrosting freezer coils, and in similar heat-transfer applications.

DOWTHERM 209 heat-transfer medium azeotropes with water and provides excellent corrosion protection for most metals. The azeotropic solution of 53 percent **DOWTHERM 209** and 47 percent water will give freeze protection to -45°F. and has an atmospheric boiling point of 209°F. It is recommended for use in ebullient cooled engines and low pressure steam boilers. Mixtures of up to 60 percent **DOWTHERM 209** may be used which give freeze protection down to -80°F.

DOWFROST* heat-transfer medium is a specially inhibited propylene glycol used for the immersion freezing of poultry and in other food and low temperature processes requiring an indirect heat transfer medium and where low toxicity is a prime consideration. It is also used for freezer coil defrosting and protecting potable water against freezing in situations where there is a chance of contamination.

*Trademark

FLOTATION AGENTS

Xanthates. These products are yellow pelletized solids which have a pungent odor and are completely soluble in water.

Xanthates are used by the mining industry as collector reagents in the flotation of sulfide minerals, metallic elements such as copper, silver, and gold, and a number of oxidized minerals of lead and copper.

Dow produces the following series of Z® xanthates:

- Z-3...Potassium Ethyl Xanthate
- Z-4...Sodium Ethyl Xanthate
- Z-5...Potassium sec-Amyl Xanthate
- Z-6...Potassium Amyl Xanthate
- Z-10...Potassium Hexyl Xanthate
- Z-11...Sodium Isopropyl Xanthate
- Z-12...Sodium sec-Butyl Xanthate
- Z-14...Sodium Isobutyl Xanthate

This series provides graduated collector power combined with high selectivity. By using the proper xanthate or xanthate combination, the efficient, economical flotation of virtually any sulfide mineral may be accomplished.

Z-200 flotation agent is an alkyl thionocarbamate used mainly to collect copper or copper-activated zinc from other ore minerals. It has been especially successful in the recovery of these minerals from ores containing iron sulfides such as pyrite or pyrrhotite.

Z-200 was developed for difficult copper-iron separations—especially those in which high lime alkalinity is undesirable. Frequently a xanthate is used in conjunction with Z-200 for the flotation of middling particles, since Z-200 has substantially no collecting properties on pyrite at lime alkalinities above pH 9.5.

DOWFROTH® 250 flotation frother is a water soluble, low viscosity liquid. With its powerful action, it usually is effective in considerably smaller quantities than required with most competitive frothers. The first major application for DOWFROTH 250 was in the selective flotation of lead and zinc sulfide minerals. These applications are still important, but an even larger-scale use has developed—the flotation of copper ores. At present DOWFROTH 250 is being used with economic advantage on a wide variety of sulfide and nonsulfide ores at pulp alkalinities ranging from pH 12.5 down to pH 3.5. Extensive mill and laboratory tests have indicated that for lime-alkaline ore pulp above pH 10.0, no frother is economically superior to DOWFROTH 250.

FLOCCULATING AGENTS

The Dow Chemical Company now has available non-ionic, anionic, and cationic synthetic flocculating agents. This family of SEPARAN® flocculants offers great versatility and economic utility to the processor faced with a difficult solid-liquid separation problem.

SEPARAN NP10® flocculant is a synthetic, water-soluble non-ionic, high-molecular-weight polymer of acrylamide. SEPARAN NP10 has the important advantage of being effective in solutions ranging from acidic to strongly basic and at very low additive levels.

The applications where this flocculant is used are: thickening and filtration of ore slurries, clay slurries, and flotation concentrates; flocculation of solids in the lime-sulfur process; clarification of potash brines; settling of impurities in borax manufacture; removal of ferric hydroxide in manganese purification; filtration of coal-washery slimes; disposal of tailings; settling of mud in alum manufacture; filtration of gyp-

sum in wet-process phosphoric acid plants, and electroplating.

SEPARAN NP10 potable water grade flocculant is a special product that has been accepted, subject to a maximum use concentration of one ppm., by the U.S. Public Health Service for treatment of potable water supplies.

SEPARAN PG2 flocculant is similar to SEPARAN NP10 but is especially adapted for use by paper companies (see page 28).

SEPARAN MGL flocculant, produced primarily for the mining industry, has proven itself throughout the entire pH range in both thickening and filtering operations. It is used extensively in potash, phosphate and uranium ore processing, to mention just a few of its many applications.

SEPARAN NP20® flocculant, like SEPARAN NP10, is a nonionic polyacrylamide polymer, but has a much greater amount of flocculating activity per pound of product. The areas of application parallel SEPARAN NP10 but both flocculants should be evaluated in each application for comparative economics versus flocculating activity.

SEPARAN AP30® flocculant is a synthetic high-molecular-weight anionic polymer. Because of its anionic characteristics, this flocculant finds application in systems where the pH is near neutral or higher. Below this pH range, SEPARAN NP10 and SEPARAN NP20 will probably be more effective.

One area of proven utility is in the clarification of coal wash water. Most coal preparation plants use considerable amounts of water in cleaning and classifying coal, and in order to reuse this water, the coal fines and the other clays must be removed. Reuse of the water also minimizes stream pollution problems. The Dow Chemical Company through its Dowell Division is prepared to offer assistance in this application.

Other promising areas include the settling of various metallic hydroxides and insoluble salts, as well as a variety of waste and miscellaneous processing applications.

SEPARAN C-90 and **SEPARAN C-120** flocculants are synthetic, high-molecular-weight cationic polymers. These products show exceptional activity in systems which are low in divalent or trivalent metal ions, or which contain silica particles. Also, systems which cannot be treated successfully with anionic or nonionic polyelectrolytes can often be flocculated by these two Dow products. Cationic polyelectrolytes ordinarily provide effective flocculation at much lower dosage levels than inorganic cationic materials.

TYDEX* 12 flocculant is especially adapted for use by the paper industry (see page 29).

ION EXCHANGE RESINS

The Dow Chemical Company produces three major types of ion exchange resins. They are: strong acid cation resin, strong base anion resins and weak base anion resins. Strong acid cation resins are capable of exchanging cations or positively charged ions, for example, sodium (Na) for calcium (Ca) and magnesium (Mg) as in softening water. The strong base anion resins are capable of exchanging anions, or negatively charged ions, and the weak base anion resin is capable of neutralizing acids. The strong acid cation resins and the strong basic anion resins are copolymers of styrene and divinylbenzene, having a large number of ionizable or functional groups attached to this hydrocarbon matrix. These functional groups determine the chemical behavior and type of ion exchange resin. This structure provides maximum resistance to oxidation, reduction, mechanical wear and breakage. These resins are insoluble in all common solvents. The weak base ion exchange resin is a con-

*Trademark

densation polymer of epichlorohydrin and ammonia and is the only Dow resin manufactured which is not based on the styrene-divinylbenzene matrix.

The standard commercial DOWEX® resins available from Dow are:

Strong Acid Cation Resins

DOWEX 50-X8, 20-50 mesh, sodium and hydrogen form
DOWEX 50W-X8, 20-50 mesh, sodium and hydrogen form
DOWEX 50-X10, 20-50 mesh, sodium form
DOWEX 50W-X10, 20-50 mesh, sodium and hydrogen form
DOWEX 50W-X12, 20-50 mesh, hydrogen form

Strong Base Anion Resins

DOWEX 1-X8, 20-50 mesh, chloride form
DOWEX 11, 20-50 mesh, chloride form
DOWEX 21K, 20-50 mesh, chloride form
DOWEX 21K, 16-20 mesh, chloride form
DOWEX 2-X8, 20-50 mesh, chloride form

Weak Base Anion Resins

DOWEX 44, 20-50 mesh, mixed chloride and hydroxide forms

In addition to the foregoing products, many special anion and cation exchange resins are available from The Dow Chemical Company, ranging in mesh sizes from 50 to 100 and 200 to 400.

The major market areas of DOWEX resins are: (a) home water conditioning, i.e., softening, (b) industrial water conditioning which includes softening, deionization, dealkalization and condensate scavenging and (c) chemical or special applications. The types of uses in this growing special or chemical marketing area include compound conversion, purification, concentration, separation or chromatography and catalysis. Industries employing DOWEX resins successfully are: mining industry for uranium recovery; pharmaceutical industry for product conversion, isolation and purification; chemical industry for liquid purification and as catalysts for epoxidation and esterification reactions; textile industry for recovery of metals from spin bath streams and the metal finishing industry for plating and etch bath recovery.

Chelating Resin. DOWEX A-1 chelating resin is available from Dow in developmental quantities. The resin contains iminodiacetate groups which impart to it a high selectivity for heavy metal cations. It exhibits excellent potential as a tool for the complete removal of trace heavy metal contamination from various chemical processing streams of high ionic concentration. In addition, the resin has the ability to separate closely related ionic species such as cobalt and nickel, and to remove alkaline earth cations from concentrated solutions of alkali metal ions.

URETHANE CHEMICALS

VORANOL® P polyols are polypropylene diols useful as intermediates in elastomers, coatings, and flexible foams. VORANOL P-750, VORANOL P-1010, and VORANOL P-1285 polyols may be used in making urethane coatings and elastomers with excellent properties. VORANOL P-400 polyol is a valuable base for prepolymers for urethane elastomers. Both slab and molding formulations may be improved with VORANOL P-2000. VORANOL P-3000 and VORANOL P-4000 make softer, very flexible coatings.

VORANOL CP polyols are polyether triols of alkylene oxides. They range from VORANOL CP-260, useful in coatings, elastomers, and rigid foams, to VORANOL CP-2700 and higher members of the series, utilized in elastomers and flexible foams. VORANOL CP-2700 and its higher homologs are especially useful in one-

shot systems for flexible foams. By appropriate selection of molecular weight and formulation, one-shot flexible foams may be produced with densities as low as 1.0 pound/foot³ and with a wide range of load-bearing characteristics.

PRODUCTS AND PROPERTIES

	Molecular Weight	Hydroxyl Number	Hydroxyl Type	Functionality
VORANOL P-400	375-425	264-299	Secondary	Diol
VORANOL P-750	700-800	140.3-160.5	Secondary	Diol
VORANOL P-1010	975-1075	105.0-115.6	Secondary	Diol
VORANOL P-1285	1155-1330	84.4-90.5	Secondary	Diol
VORANOL P-2000	1950-2050	54.7-57.5	Secondary	Diol
VORANOL P-3000	2750-3250	31.7-39.6	Secondary	Diol
VORANOL P-4000	3660-4350	24.7-31.0	Secondary	Diol
VORANOL CP-260	249-264	644-676	Secondary	Triol
VORANOL CP-450	430-460	366-392	Secondary	Triol
VORANOL CP-700	650-750	244-259	Secondary	Triol
VORANOL CP-1000	1050-1150	146-160	Secondary	Triol
VORANOL CP-2100	2000-2200	76.0-84.2	Secondary	Triol
VORANOL CP-2700	2550-2850	59.0-66.0	Secondary	Triol
VORANOL CP-3000	2850-3150	53.4-59.0	Secondary	Triol
VORANOL CP-4000	3700-4100	41.1-45.5	Secondary	Triol
VORANOL CP-5000	4500-5100	34.0-39.0	Secondary	Triol

Special Polyols for Flexible Foam. VORANOL CP-3500 polyol is an all-purpose product for high, intermediate, and low density slab stock foam. VORANOL CP-3720 produces slab stock with better elongation without loss of load bearing, and is best for foams weighted with mineral fillers. VORANOL CP-2921, VORANOL CP-3421, and VORANOL CP-3331 are used in flexible foam closed-type molding. VORANOL CP-3001 is used for molding, for prepolymers and scrap foam bonding, and for slab stock foam, particularly when blown with a methylene chloride stabilized for urethanes.

	Approximate Molecular Weight	Hydroxyl Number
VORANOL CP-2921	2900	54.4-61.1
VORANOL CP-3001	3000	54.3-62.3
VORANOL CP-3331	3300	47.7-53.9
VORANOL CP-3421	3400	45.4-51.6
VORANOL CP-3500	3500	44.3-49.5
VORANOL CP-3720	3700	43.5-48.5

VORANOL R polyols are polyether polyols of proven worth as intermediates in rigid urethane foams. When used as crosslinkers in conjunction with isocyanate adducts or in one-shot systems, these materials permit production of rigid foams which can be foamed in place with exceptional ease. Rigid urethane foam finds application in thermal insulation for refrigerators, freezers, reefer trucks and cars; structural core material for building panels, boats, and aircraft; buoyancy media; and energy or shock absorption in packaging. These systems lend themselves to application by spraying, frothing, or pouring-in-place.

Pour-in-place formulations can provide foams with densities from 1.5 to 40.0 pounds/foot³. When expanded with fluorocarbon blowing agents, systems using VORANOL products yield foams with initial "k" factors of 0.11 which after two years at 150 °F. in cut specimens reach equilibrium at 0.16 and remain as low as 0.12 in samples foamed between steel skins. These foams may be made self-extinguishing and exhibit excellent adhesion to most surfaces.

PRODUCTS AND PROPERTIES

	Hydroxyl Number	Hydroxyl Type	Functionality
VORANOL RF-380	365	Secondary	—
VORANOL RN-490	490	Secondary	—
VORANOL RN-600	600	Secondary	—
VORANOL RQ-450	450	Secondary	hexa
VORANOL RQ-490	490	Secondary	hexa
VORANOL RQ-555	555	Secondary	hexa
VORANOL RQ-610	610	Secondary	hexa
VORANOL RQ-640	640	Secondary	hexa
VORANOL RS-350	350	Secondary	octa
VORANOL RS-375	374	Secondary	octa
VORANOL RS-410	410	Secondary	octa
VORANOL RS-450	443	Secondary	octa
VORANOL RS-530	528	Secondary	octa
VORANOL UI-800	800	Secondary	tetra

VORANOL UI-800 is used in fast-reacting rigid foam formulations and spray applications.

See page 5 for other polyglycols useful in urethane foams. Extensive formulation data and literature covering the above classes of products are available.

CONSUMER PRODUCTS

Dow is placing increased emphasis on manufacture of products that go directly to the consumer, with new products being added regularly to the line. This section discusses the products that are marketed directly to the consumer.

SARAN WRAP* household film is the first of the company's consumer products, having been introduced nationally in 1953. Several major product changes were made during 1964, including doubling the roll length without increasing retail price, addition of a starter tab to facilitate unrolling and handling, and a new easy-open package which minimizes lost wrap ends. The changes were well received by consumers, and SARAN WRAP continues to gain wide usage as a packaging material for storage of food and non-food items. The clear, clinging wrap has an unusually high moisture-vapor-odor barrier which also makes it an ideal freezer wrap. SARAN WRAP is available in three sizes—12 inches by 50 feet (Regular), 12 inches by 100 feet (Jumbo), and 18 inches by 50 feet (Queen).

HANDI-WRAP® polyethylene wrapping material is designed for household use wherever waxed paper can be employed. It is clear, leak-proof, and keeps foods far fresher far longer than waxed paper. This Dow product is authorized to display the Good House-keeping Seal of Approval. Introduced in 1960, HANDI-WRAP continues to outsell all competitive polyethylene wraps. It is available in rolls 11½ inches wide in lengths of 50, 100, and 200 feet, priced competitively with waxed paper.

HANDI-WRAP sandwich bags are clear polyethylene sandwich bags for lunch use. The bags are 6⅞ inches by 8⅞ inches. They are packed individually in the exclusive MAGIC DOT® box which allows them to be dispensed one at a time with one hand. Each bag has a lip at the top for easy opening. HANDI-WRAP sandwich bags are available in 50 and 100 count packages.

Dow Oven Cleaner is an aerosol formulation containing ammonia, sodium hydroxide and other chemical cleaning agents. The product is designed to be applied to a soiled oven which has been preheated to 200°F., then turned off. After the warm oven surfaces have been sprayed and the cleaner allowed to work for five to 10 minutes, condensed greases and food substance spills can be wiped out with a damp cloth or sponge.

Dow Oven Cleaner is safe to use on porcelain and chrome oven surfaces, as well as on glass, ceramics, stainless steel and cast iron. It is not necessary to wear protective gloves when the product is used as directed. Both 9-ounce and 16-ounce sizes are available.

Dow Bathroom Cleaner is an aerosol foam cleaner for bathroom fixtures, tile, chrome hardware, and other bathroom areas. It is a formulation containing detergents and cleaners with TUASAL antimicrobial agent and other sanitizing agents added. Dow Bathroom Cleaner is a non-abrasive cleaner and leaves no gritty residues. It deodorizes and sanitizes and prevents the growth of staph, strep, mold and mildew, and also cleans and shines chrome without polishing. It is packaged in a 17-ounce aerosol can which sprays upright or inverted for convenience in getting at hard-to-reach places.

BIOPRODUCTS

Operating on a strong research basis, The Dow Chemical Company is a leading world supplier of biologically active products for plant science and human and animal health.

plant science products

Weed and Brush Killers. Heading the list of weed and brush control products is the line of specially formulated esters of 2,4-D and 2,4,5-T. The line includes such products as: ESTERON 99® and ESTERON® 99 Concentrate herbicide formulations of 2,4-D. Other members of the family are ESTERON Brush Killer O. S. and ESTERON 245 O. S., oil soluble formulations designed to meet industry demands, and ESTERON 245 concentrate, a six pound formulation of 2,4,5-T.

Industrial cousins to the ESTERON herbicide line are the VEON® herbicides—VEON brush killer and VEON 245—which are amine salts of 2,4-D and 2,4,5-T developed for the industrial trade.

KURON® hormone-type weed and brush killer is especially effective for hard-to-kill oaks and maples. KURON is recommended as a safe and effective control agent for many common species of aquatic weeds and is extensively used to control weeds in sugar cane.

FORMULA 40® weed killer is a widely used amine formulation of 2,4-D for use in wheat, sugar cane, rice, corn and sorghum. Dow MCP Amine Weed Killer is similar, but contains MCP and is used especially in rice, flax, legumes and oats.

WEEDBEADS® herbicide is used for pre-emergence weed control in soybeans. This material is sodium pentachlorophenate in bead form.

PREMERGE® dinitro weed killer is effective in both pre-emergence and post-emergence applications to control many seedling weeds and grasses in peanuts, soybeans, lima beans, potatoes, corn, peas, alfalfa, certain other crops, and in orchards.

Dow General Weed Killer acts as a contact weed killer for most annual weeds and grasses, and as a chemical "frost" or desiccant for seed crops. It is also used as a floor spray in fruit orchards.

TORDON® herbicide, one of Dow's newest, is used for killing a wide variety of deep-rooted perennial herbaceous weeds and woody plants.

TORDON 101 Mixture is effective on most woody plant species, including conifers, as a foliage spray. TORDON 10K Pellets are applied to the soil and, via

*Trademark

root uptake, control the same species as TORDON 101 Mixture. TORDON 22K Weed Killer is outstanding in controlling deep-rooted perennial weeds, but also controls brush. It is applied as a water spray to foliage or soil. An important advantage of this herbicide is its safety to grasses. As normally used, grasses are not seriously damaged on right-of-ways and other areas where recommended. TORDON can be used for spot treatment of problem areas in croplands.

Grass Killers. The Dow herbicide line includes DOWPON®, RADAPON®, and Sodium TCA grass killers.

DOWPON grass killer, based on Dalapon† is the most widely recognized systemic chemical grass killer product. Its uses include the following: preplant treatment to control Johnson grass and quack grass in cropland; spot treating grasses in cotton fields and in orchards of grapes, citrus fruits, apples, pears and bananas; directed spraying in corn; seedling grass control in flax, peas, potatoes, and sugarcane; grass, cattail and sedge control in fence rows, ditches, etc.

DOWPON C grass killer is a new product for non-cropland use. Containing both TCA and Dalapon, its top-kill action is fast and the root-rhizome kill excellent. RADAPON herbicide is also based on Dalapon and is intended for industrial use. Dow's Sodium TCA is a 95 percent formulation used by both agriculture and industry.

Lawn and Garden Products. The introduction of Dow Crab Grass Killer marked Dow's entrance into the home lawn and garden market.

The pre-emergent product is based on ZYTRON® herbicide which was discovered by Dow and which kills crab grass selectively without harming the desirable lawn grasses. Dow Crab Grass Killer was performance tested in Dow laboratories and field applications for four years, as well as consumer market tested for two more years. In addition, it has received high ratings in exhaustive tests conducted by agricultural experiment stations of numerous state universities and independent turf agencies. It is sold through garden supply centers, hardware stores, department stores and other retail outlets for lawn products. Many lawn fertilizers of national manufacturers contain ZYTRON herbicide.

Non-Selective Herbicide. BARON® herbicide is for use at industrial plant sites where all vegetation is to be controlled. It has residual properties to extend vegetation control over the entire season. Heavy applications of sodium TCA (200-300 pounds per acre) are also quite effective in providing extended vegetation control.

Fertilizers. Anhydrous ammonia fertilizer contains the highest analysis of nitrogen of any fertilizer available to agriculture. Anhydrous ammonia is a gas compressed to a liquid which is injected directly into the soil. Dow also offers a line of chelates and chelating agents for use in making trace minerals and secondary soil nutrients available to plants for growth. Chelates and chelating agents are available in the form of VERSENE for acid soils and as formulations of VERSENL for all soil types.

Soil Fumigants. Dow offers the industry's most complete line of soil fumigants: DOWFUME® W-85, TELONE®, VIDDEN® D, DORLONE®, FUMAZONE® 86, PICFUME®, and DOWFUME MC-2 fumigants. Selection of a specific fumigant depends upon the pest to be controlled, climate or soil conditions, and the economics of crop production.

BROZONE® fumigant, a liquid formulation of methyl bromide in solvent, and TRIZONE® soil fumigant control weeds, nematodes, and fungi in the soil. Exceptional yield increases following the use of TRIZONE soil fumigant testify to its effectiveness.

Space and Grain Fumigants. Dow is the acknowledged leader in research, production and service in protection of stored commodities by fumigation, and the only company offering a complete analysis service for fumigant customers.

PROFUME® fumigant is an odorized methyl bromide product. Liquid grain fumigants are offered in various combinations of carbon tetrachloride, carbon bisulfide, ethylene dibromide, sulfur dioxide and ethylene dichloride. Spot fumigants for cleaning up equipment in mills and in the tobacco trade are based on a higher percentage of ethylene dibromide.

VIKANE® space fumigant is used for control of the dry wood termite and is the recognized leader in this field.

human health products

Dow is active in human health through the Pitman-Moore Division and through association with Ledoga S. p. A. of Milan, Italy; LIFE, S. A. of Quito, Ecuador; and Bio-Science Laboratories, Van Nuys, California.

General offices of Pitman-Moore and a pharmaceutical plant are located in Indianapolis, Indiana. Biological laboratories and extensive research facilities are at nearby Zionsville, Indiana. Pitman-Moore is one of the nation's largest producers of biological products and a pioneer in the development of tissue culture vaccines. LIRUGEN® measles virus vaccine, live, attenuated (Schwarz strain), introduced in 1965, is the leading measles vaccine. It is a single-shot vaccine. Other important Pitman-Moore products for human use are:

NOVAHISTINE® antihistaminic and decongestant.

NEO-POLYCIN® ointments and solutions.

ORIFER® nutritional supplement for pregnancy, introduced in 1966.

EMDEE® margarine.

PHENOXENE® brand of chlorophenoximine hydrochloride.

The division also produces various combinations of basic immunization products for infants and children, along with GAMULIN® serum, commonly known as "gamma globulin."

animal bioproducts

The division is active in many areas of animal health. Major categories of development are feed additives, pesticides, biologicals and pharmaceuticals. Specific products such as the examples listed below total more than one hundred fifty.

Animal bioproducts facilities and personnel are as widespread and diversified as the industry itself. Specialty products and basic commodities benefiting all from grower to consumer are sold to research institutions, formulators, the animal health dealer-distributor complex. In addition, a professional line of products, bearing the Pitman-Moore label, is sold exclusively to veterinarians.

feed additives

DOWZENE® wormers are formulations of piperazines useful in the control of roundworms in all species of animals. Dow manufactures products applicable in both feed and drinking water.

Methionine Feed Supplement is a synthetic source of DL-methionine which is finding broad use in supplementing natural proteins to their maximum efficiency in the feeding of poultry and livestock.

†Dow trademark abroad

Ronnell† and **TROLENE®** systemic insecticides are useful in the control of dung-breeding flies and systemically in the control of cattle grubs.

ZOAMIX® coccidiostat is employed throughout the world as an ingredient in poultry feeds to aid in the prevention of coccidiosis, a serious economic disease of poultry grown under commercial conditions.

SIRLENE® feed grade propylene glycol is being used today as a feed conditioner and for the prevention of ketosis, a nutrition disease of high-producing dairy animals.

animal pesticides

KORLAN® 24E insecticide is used for control of flies, lice and other pests on livestock and as a general spray. It is water emulsifiable and oil soluble and can be applied as a residual spray in buildings, directly to animals, or on cattle backrubbers.

RUELENE® cattle insecticide is effective in the control of cattle grubs, lice and hornflies on cattle. A systemic material, it is easily applied by the "pour-on" method or as a spray. RUELENE is available in two formulations, RUELENE 25F insecticide, a concentrate, and RUELENE 8R which is ready for use without dilution.

STEER-KLEER® insecticidal mineral feed for cattle contains Ronnell†. Available in block or granular form, it is fed free-choice during the summer months to control hornflies and cattle grubs.

TROLENE FM insecticide is a systemic insecticide product for mixing with feed for the control of cattle grubs in beef cattle. This procedure also aids in the reduction of cattle lice. The active ingredient in TROLENE FM is Ronnell.

biologicals

TISSUVAX®-4 tissue culture vaccine is a combination of antigens used for the immunization of healthy, unexposed puppies and dogs against canine distemper, canine hepatitis, and *Leptospira* infections.

Feline Distemper Vaccine—Homologous is used for the active immunization of cats and other members of the feline family against feline distemper. The vaccine is highly effective and gives lasting immunity.

NEUMOVAX® vaccine is a modified live virus vaccine used for the active immunization of cats against feline pneumonitis.

GLOBULON® globulin, a solution of refined and concentrated canine globulins, is an aid in the prevention and treatment of canine hepatitis, and the common secondary bacterial infections.

MUCOVAX® vaccine is a modified living virus vaccine for the prevention of the bovine virus diarrhea disease complex in beef and dairy cattle. The companion product, **VYNOC®** vaccine carries the Dow label and is sold to commercial feedlots in the West.

LEPTOGEN® bacterin is a sterile, whole culture bacterin for the immunization of cattle and swine against *Leptospira pomona* infections. The disease is of serious economic consequences because it tends to induce abortions in swine and cattle and causes death losses up to 25 percent in calves.

RHUSIGEN® bacterin is used for the prevention of erysipelas infection in swine and turkeys.

Erysipelas Bacterin (Lysate) is a killed, lysed culture of *Erysipelothrix rhusiopathiae*. For active immunization of turkeys against erysipelas.

pharmaceuticals

METOFANE® brand of methoxyflurane.

BACTROVET® brand of sulfadimethoxine.

VERMIPLEX® anthelmintic, supplied in capsule form, is a broad action anthelmintic for small animals. It is used in the control of tapeworms, ascarids, and hookworms of dogs, cats, and other small animals. VERMIPLEX is also helpful in the routine control of whipworms in dogs.

HI-AMINE® compound is used for the prevention and treatment of foot rot in cattle, as an expectorant in respiratory disease of animals, as a source of nutritional iodine, and as an aid in the prevention and control of soft tissue infections caused by *Actinobacillus lignieresii*.

VITAMYCIN® vitamin-mineral tonic and nutritional supplement is used as a nutritional aid to promote general health, growth, body weight and condition of skin and hair coat in both large and small animals.

V-TERGENT®-8X detergent is a general veterinary detergent and deodorant used as a germicide on inanimate surfaces, for equipment cleaning, handwashing and preparation of the patient's skin for surgery.

METHYLCELLULOSE PRODUCTS

METHOCEL methylcellulose products are colorless, odorless, tasteless, water- and organic-soluble surface active materials available in powder, granular, and dispersible granular form. The various chemical types range from the simple dimethyl ether of cellulose to propylene glycol ethers of methylcellulose with varying ratios of hydroxypropoxyl to methoxyl groups.

METHOCEL products have the unusual property of being soluble in cold water but not in hot water. Thus, when the temperature of a solution of **METHOCEL** is raised above a certain critical point, called the gel point, the **METHOCEL** gels from solution. Gelation is reversible, the gel becoming a clear solution again upon cooling.

Extensive tests with laboratory animals have shown that the MC and HG types of **METHOCEL** are not skin irritants and that diets containing as much as 5 percent of any of these products over an extended period cause no ill effect. Experiments with human beings have demonstrated that there is no measurable loss of methoxyl groups during passage of these products through the digestive tract. These results indicate the suitability of **METHOCEL** MC and **METHOCEL** HG for food and pharmaceuticals.

METHOCEL products are used in the following industries: cosmetic, latex, chemical processing, pharmaceutical, paint, paint remover, paper, food, plastics, textile, construction, rubber, tobacco, and agriculture. In these applications they may function as thickeners, suspending agents, dispersants, binders, film formers, water retention aids, emulsion stabilizers, or display a combination of these properties. Films and coatings of **METHOCEL** are tough, clear, impervious to oils and greases, and water soluble, though they may be made insoluble with crosslinking resins. Detailed literature on each of these applications is available on request.

Certain **METHOCEL** products are used in the modification of portland cement masonry mortars. Mortars and grouts containing **METHOCEL** exhibit improved water retention, workability, bond strength and other properties.

*Trademark

†Dow trademark abroad

A number of the METHOCCEL products have a long history of use as emulsifiers, film formers, protective colloids, stabilizers, suspending agents and thickeners by the food industry. The methylcellulose products designated METHOCCEL MC, premium are generally recognized as safe for food use. The hydroxypropyl methylcellulose products designated METHOCCEL HG, premium are acceptable for use as food additives by orders published in the *Federal Register*. The standards of identity for french and salad dressings permit the use of the premium grades of methylcellulose and hydroxypropyl methylcellulose as optional emulsifiers. The standards of identity for sherbets and ices permit the use of the premium grades of hydroxypropyl methylcellulose as optional emulsifiers and stabilizer ingredients.

The following METHOCCEL products are available from Dow:

METHOCCEL MC premium†

METHOCCEL MC standard

Both have lowest thermal-gelation temperature (50°C.), form the firmest gel. Useful for general thickening, suspending and film forming applications.

METHOCCEL 60HG premium‡

Used as surfactant, emulsion stabilizer, film former, thermoplastic, and where high organic solubility is required.

METHOCCEL 65HG premium‡

METHOCCEL 65HG standard

Both have excellent compatibility with a wide range of formulating ingredients.

METHOCCEL 70HG premium‡

METHOCCEL 70HG standard

Both useful for industrial emulsions, particularly petroleum-based.

METHOCCEL 90HG premium‡

METHOCCEL 90HG standard

Both are tailored for those uses where thermal gelation below 90°C. is a disadvantage.

METHOCCEL DGS standard

A grade which is dispersible in room temperature aqueous solutions.

METHOCCEL HB

Especially efficient as a thickener in organic solvent systems.

†Meets USP specifications
‡Meets NF specifications

METHOCCEL products are available in a wide range of viscosities which will produce aqueous solutions of 10-50,000 cps. at 2 percent concentration at 20°C.

AROMATIC CHEMICALS

Aromatic chemicals are a group of synthetic organic products employed primarily for their odor or flavor value. Synthetic aromatic chemicals are especially desirable because they offer stability in quality, availability, and a price not possible with natural products.

The Dow Chemical Company products make an important contribution to the aromatic and flavor fields. These chemicals find wide usage in soap and cosmetic perfumery, and in flavor compounding.

Dow sells the following aromatic chemicals: C-64®, Coumarin, CYCLOTENE®, DORISYL®, refined, Methyl salicylate, U.S.P., PALATONE®.

SURFACE-ACTIVE AGENTS

BENAX 2A1 surfactant has a broad range of proven and potential utility in household and industrial applications. Chemically, the product is dodecyldiphenyl

ether disulfonic acid, sodium salt, and is an anionic surface-active agent. It is a moderate sudsing agent which is susceptible to foam boosting and defoaming additives, displays unusually high stability, and is highly soluble in water as well as in solutions of many inorganic compounds. It scores high in its ability to cut wetting time and to lower both surface tension and interfacial tension in water and electrolyte solutions.

BENAX 2A1 surfactant is formulated in detergent-disinfectants. It displays excellent promise in industrial and household cleaning; in kier boiling of cotton; in mercerizing cotton; in oil well acidizing; in water flooding operations; and in sulfite, sulfate, and semi-chemical processes in paper manufacturing.

In addition, it is suggested as an additive to reduce viscosity of slurries, as an additive to promote chemical reaction when wetting out is important, as a coupling agent for organic materials in water, and as the primary emulsifier for most latexes.

BENAX 2A1 is available as a 45 percent active solution and a light-colored, free-flowing 90 percent active powder.

BENAX 2A0 designates a product which consists predominantly of dodecyldiphenyl ether disulfonic acid and is sold as a 40 percent active solution. It is a highly surface-active product which can be reacted with many metal oxides to yield water-soluble surface-active salts. These include many metallic species—for example, calcium, cobalt, copper, zinc, silver, iron, nickel, and barium—most of which otherwise form insoluble salts.

The metallic salts find utility as heat stabilizers for vinyl resins, as emulsifiers and stabilizers for latexes, as drying catalysts, and as fungicides. The amine salts can also be made and are useful in preparing agricultural chemical, chlorinated solvent, and hydrocarbon emulsions.

DOWFAX 9N surfactants are nonylphenoethylene oxide adducts. The last number in the product name indicates the average number of moles of ethylene oxide condensed per mole of nonylphenol. Members of this family of products are DOWFAX 9N4, DOWFAX 9N6, DOWFAX 9N9, DOWFAX 9N10, and DOWFAX 9N15. These nonionic surfactants are employed extensively in the formulation of household, institutional, and industrial cleaners, and are widely used in such industries as textiles, pulp and paper, leather, and latex paint.

METHOCCEL products are surface-active nonionic polymers. For a more detailed discussion of these products see "Methylcellulose products", page 27.

PAPER CHEMICALS

MYDEL® 550 paper resin is a water-soluble acrylamide-type product used to improve the strength properties of chemical and groundwood pulps. Specific strength properties which may be improved include bursting and tensile strength, folding endurance, and surface pick. The use of MYDEL 550 paper resin makes it possible to increase the percentage of inexpensive mechanical pulps in chemical-mechanical pulp mixtures and still maintain strength properties. Other advantages obtained include improved drainage, wet web strength, and resin retention.

SEPARAN PG2 flocculant has been utilized by the paper industry in a wide range of applications. It serves as a filler retention aid, and as a floc aid or primary flocculant in flotation-type save-alls, process water treatment, white and green liquor clarification and filtration, bleach liquor settling, and the treatment of mill waste effluents.

TYDEX 12 flocculant is employed as a drainage aid, drying improver, alkaline retention aid and flocculation aid in save-all operations.

Magnesium Hydroxide is used as a source of base for magnesium-based sulfite processes. The use of this base has greatly increased the versatility of these processes.

VERSENEX 80 chelating agent is utilized for treating pulp slurries prior to the application of alkaline peroxide bleach liquors. Treatment prevents decomposition of the hydrogen peroxide and results in a pulp with increased brightness and significantly reduced brightness reversion. It also prevents general brightness reversion in refiner groundwood and chemi-groundwood pulps.

Other Dow products for the paper industry include caustic, chlorine, DOWICIDE preservatives, METHOCEL methylcellulose, calcium chloride, DOWFAX 9N surfactants, BENAX 2A1 surfactant, epsom salt, muriatic acid, latexes and coating materials.

WATER AND WASTEWATER TREATMENT PRODUCTS

FLOCCULANTS. PURIFLOC® flocculants are available for the clarification of water and wastewater, and, along with ferric chloride, for the concentration and dewatering of waste slurries. The use of PURIFLOC flocculants in wastewater clarification makes possible economic instant abatement.

The PURIFLOC flocculants, tailored specifically for water and wastewater treatment applications, can improve solid-liquid separation process efficiencies to unprecedented levels. In most applications, the PURIFLOC flocculant is used alone. Some applications, however, require more than one flocculating agent for optimum results: e.g. two PURIFLOC flocculants with different electrical charges (anionic and cationic) can often condition sludges for dewatering more economically than one, and the clarification of low solids waters often requires the use of an inorganic flocculant with a PURIFLOC flocculant.

PURIFLOC A21 and PURIFLOC C31 were especially designed for treatment of wastewaters containing a predominance of organic solids. These high-molecular-weight polymers have proved to be useful tools in the following municipal and industrial waste applications: sewage clarification; clarification of numerous industrial wastewaters; conditioning of slurries prior to concentration and/or dewatering using vacuum filters, sand beds, centrifuges, gravity settling tanks, and air flotation tanks. Both of these flocculants have also proved effective in clarifying non-potable industrial water supplies.

PURIFLOC N17 potable water grade flocculant is a special product that has been accepted, subject to a maximum use concentration of one ppm., by the U.S. Public Health Service for treatment of potable water supplies.

PURIFLOC N11, PURIFLOC N12, PURIFLOC A22, and PURIFLOC C32 flocculants are also excellent for various water and wastewater applications. The first three are particularly useful for water clarification and for the clarification of wastewaters containing a high percentage of inorganic solids. PURIFLOC C32 is used in the same applications as PURIFLOC C31.

The use of PURIFLOC flocculants in water and wastewater systems can result in higher production rates, lower chemical costs, elimination of inorganic flocculants, minimized equipment maintenance, and in-

creased solids removal in clarification or concentration units. The overall result is a much more efficient treatment system.

Ferric chloride has a long history of successful use in water and wastewater treatment processes; it is particularly useful as a sludge conditioning chemical prior to vacuum filtration. If the sludge is highly alkaline, a dual chemical treatment using lime with the ferric chloride is often required.

Biological Oxidation Media. SURFPAC® biological oxidation media is used in the aerobic biological destruction of sewage and industrial wastewaters. This product, fabricated from chemically resistant Sarant, distributes applied wastewater in thin films, and provides a high surface area per unit volume and a high void fraction for unimpeded countercurrent waste and air flow. SURFPAC can compete economically with other biological treatment processes. This is possible because the material is lightweight and is effective under conditions of high organic and hydraulic loading rates. It is finding increasing use in solving the pollution problems of both industry and municipalities.

Pilot demonstration units are available on a lease basis for investigations of specific wastes where performance data is not available. The data generated from such a unit is directly applicable to a full-scale unit operating on the same waste. Dow works with the consulting engineer or contractor to design, engineer, and construct the unit and then to place the unit in operation.

Waste Pond Insulation and Trickling Filter Covers. STYROFOAM® brand expanded polystyrene has shown utility in the insulation of wastewater oxidation ponds and as a cover for biologic trickling filters. In addition to its lightweight and high insulating efficiency, the expanded polystyrene has the advantages of high structural strength, good resistance to water penetration, and inability to support micro-organism growth. As biological fermentation is temperature-dependent, it is important that the waste temperature be kept as high as possible. When used with oxidation ponds, the STYROFOAM polystyrene foam is assembled into rafts which are then chained together to form a blanket on the surface of the pond. When used for trickling filter cover, STYROFOAM polystyrene foam is formed by a "Spiral Generation" process into segments of a sphere. The cover keeps the filter operating during winter months by preventing icing. It also eliminates fog, channels odors, improves the treatment plant appearance, and offers the possibility of increased treatment by minimizing wastewater cooling.

PLASTICS PRODUCTS

The Dow Chemical Company, which produced the world's first commercially available polystyrene in 1938, has consistently pioneered in the research and development of monomers and polymers for molding and extrusion, construction, and coatings applications. Today, Dow is one of the leading suppliers of basic plastics materials to the world's industries.

molding and extrusion materials

Dow produces an extensive line of basic raw materials for use in molding and extrusion fabrication processes. These materials, produced in a variety of formulations, answer nearly all requirements for chemical or physical properties in finished products. Dow plastics, available in granular or powder form, adapt to injection molding, blow molding, extrusion, compression molding, calendering, sheet forming, and all other commonly used thermoplastic fabrication techniques.

†Dow trademark abroad

STYRON® polystyrene

Dow pioneered the development of polystyrene plastic, and today is the largest manufacturer of this versatile thermoplastic resin.

STYRON polystyrene has generally excellent physical and dielectric properties; excellent resistance to many chemicals; dimensional stability; and low specific gravity. It is produced by Dow in an almost unlimited range of translucent and opaque colors, as well as natural and crystal.

STYRON resins may be separated into several categories. These are: general purpose, medium impact, high impact, heat resistant, impact-heat resistant, and light stabilized resins. Resins in each of these categories are available in specialized formulations to answer specific industrial requirements.

general purpose. Those STYRON resin formulations designated as 666, 678, 683 and 690 are categorized as general purpose resins. The formulations vary in flow characteristics, heat distortion temperatures, toughness and moldability. STYRON 666 and STYRON 683 are designed for molding and extrusion applications, while STYRON 678 and STYRON 690 are intended for molding use.

Typical applications for general purpose polystyrene resins include packaging, toys, and appliance parts.

medium impact. Those STYRON resins which may be classified as medium impact are designated 322, 333 and 338. The resins are designed primarily for molding applications.

All these resins exhibit good impact resistance. Other physical and chemical properties vary, allowing the selection of a medium impact resin tailored to specific needs.

Typical applications for medium impact polystyrenes include bottle closures and containers.

high impact. Two high impact STYRON resins, designated 454 and 456, are designed for molding applications. STYRON 475 is designed for both molding and extrusion applications requiring high impact strength, while STYRON 453 is intended primarily for extrusion operations. An *extra* high impact formulation, STYRON 597 resin, is designed for use in both molding and extrusion operations.

Typical applications for high and extra high impact polystyrenes include refrigerator breaker strips, hot and cold drink cups, toys, and thin wall packages.

impact-heat resistant. STYRON 363 polystyrene is a medium impact resin with excellent heat resistance. It is designed for use in both molding and extrusion fabrication operations. STYRON 492, also heat resistant, is a high impact resin suitable for both molding and extrusion.

These resins find use in the manufacture of such items as television cabinet backs, automotive components and machine housings.

light stable. STYRON VERELITE® 672 and STYRON VERELITE 673 resins are general purpose, light stabilized formulations intended for use in molding applications and in extrusion fabrication, respectively.

STYRON VERELITE 374 resin is a medium impact, light stabilized resin which is adaptable to fabrication by both molding and extrusion processes.

Light stabilized resins find use in the manufacture of products such as indoor signs, interior lighting appliances and window decors.

expandable polystyrene

PELASPAN® expandable polystyrene formulations are designed for the production of items which require

low density and light weight, and with special characteristics such as thermal insulating ability, buoyancy and land shock absorption.

Each bead of PELASPAN contains an expanding agent which is activated by heat. When placed in a retaining mold and heated (usually with steam), PELASPAN expands to a uniform density. Depending on the end-use, this density may be made to vary from one to 10 or more pounds per cubic foot.

Items molded of PELASPAN have a smooth surface texture, sharp detail, low water absorption, low vapor transmission, no odor, and a high strength-to-weight ratio due to the internal closed-cell structure.

PELASPAN 222 resin is a general purpose molding formulation. PELASPAN 133 and PELASPAN 127 are designed for use in molding flame retardant items. PELASPAN 101 pellets are internally colored, and provide more intense color than is possible with dry-blended pigments.

FROSTWOOD® expandable polystyrene is a special formulation designed for injection molding. The product produces a finished item which has a foam core surrounded by a smooth, hard, noncellular polystyrene surface skin. The surface skin has a grain and texture strongly resembling wood.

FROSTWOOD may be fabricated on standard injection molding machines equipped with a plunger prepositioning mechanism.

End uses for this material include housewares, double wall insulated containers, decorative packages and buoyancy items.

PELASPAN-PAC® loose-fill polystyrene foam strands have been developed by Dow for use as a loose-fill packaging material. When this product is expanded, it forms an extremely low density cushion packaging medium with significant advantages over conventional materials.

PELASPAN-PAC exhibits high resiliency with no settling; it has a neutral pH factor and is non-hygroscopic; it is non-corrosive; it offers no food value to rodents or insects.

Dow manufactures PELASPAN-PAC in a small size intended for packaging delicate items such as glassware, electronic instruments and ceramics. A larger size of this material is intended for packaging hardware, tools, or heavy but delicate items such as business machines.

ZERLON® methyl methacrylate-styrene

ZERLON methyl methacrylate-styrene copolymer is designed to answer industrial demands for a thermoplastic which has crystal clarity, heat resistance, good physical properties, outdoor weatherability and light stability. It is available in two formulations: ZERLON 150, an easy-flow product, and ZERLON 155 resin, which exhibits moderate flow characteristics. Both are suitable for injection molding and extrusion applications.

ZERLON is ideally suited for automotive applications, lighting diffusers, outdoor signs, greenhouses, appliance control panels and knobs, brush backs, telephone finger dials, TV lenses and packaging containers.

Saran

Saran† is the name given to the line of polyvinylidene chloride resins produced by Dow. The polymers are colorless, odorless and tasteless; have extremely low water absorption and vapor transmission; and offer exceptional resistance to most chemical compounds, including many organic solvents. They are tough, abrasion resistant, and not noticeably affected by aging.

†Dow trademark abroad

Saran 115E, 422, 723, 820 and 909 formulations are designed for the production of monofilaments by extrusion. Multifilaments and fine fibers may be produced from Saran 746 formulation by extrusion. Formulation 864 is designed for the extrusion of tubing and sheeting. Pipe fittings and other miscellaneous industrial items may be molded from Saran 281 formulation.

Woven Saran monofilaments are used in the manufacture of colorful and durable outdoor furniture webbing; radio, TV and phonograph speaker grille cloths; brush bristles, dolls' hair and dust mops.

polyvinyl chloride

Polyvinyl chloride (PVC) resins are available from Dow in various molecular weights, and are furnished as free-flowing unformulated white powders suitable for dry blend processing. These resins feature controlled particle size, excellent color and clarity, and excellent heat and light resistance. They may be formulated into compositions for calendaring, molding and extrusion.

The resins are compatible with many different plasticizers and additives, making it possible to tailor them to particular processing and end-use requirements.

PVC is used in rigid products as well as elastomeric types such as raincoats, shower curtains, electrical insulation, garden hose, phonograph records and gaskets.

Dow produces eight PVC resins differentiated by molecular weight. These resins are:

- PVC 100-4;** high molecular weight
- PVC 144;** moderately high molecular weight
- PVC 188;** medium high molecular weight
- PVC 111-4;** medium molecular weight (general purpose)
- PVC 133-4;** medium molecular weight
- PVC 122;** medium low molecular weight
- PVC 177;** low molecular weight
- PVC 166;** extra low molecular weight

Compounds with PVC are also available. These are designed primarily for application in the area of shape and profile extrusion, injection molding, and wire and cable covering, where flexibility is an important characteristic. The compounds are variously available as dry blend powders and as pellets. Some are suitable for FDA-MID regulations.

ETHOCEL® ethylcellulose

ETHOCEL ethylcellulose resins have the outstanding ability to withstand shock and maintain toughness over a temperature range of 200F. to -40F. In addition, they have high strength, light weight, no odor, dimensional stability, and chemical resistance to nitroglycerine. ETHOCEL is available in a full range of transparent, translucent and opaque colors.

All members of the ETHOCEL ethylcellulose family may be fabricated by molding and extrusion. The members and their outstanding properties are:

- ETHOCEL 860;** general purpose resin with hardness and rigidity
- ETHOCEL 855;** extremely rigid
- ETHOCEL 856;** excellent dimensional stability
- ETHOCEL 870;** good impact and high heat resistance
- ETHOCEL 880;** extremely high impact resistance at low temperatures

Products made from ETHOCEL include flashlight cases, tooth brushes, vacuum cleaner parts, toilet seats, refrigerator breaker strips, football helmets, furniture trim and automotive parts. Because of its high shock resistance, ETHOCEL is used in many military applications such as forming tools for the aircraft industry.

TYRIL® styrene-acrylonitrile

TYRIL styrene-acrylonitrile copolymers have good chemical resistance, a good balance of physical properties, and moderate toughness. TYRIL is resistant to acids, bases, and many solvents, including aliphatic hydrocarbons. TYRIL can be readily colored, and is processable by both molding and extrusion.

Typical applications for these products are appliance housings, tumblers, cutlery handles, bristles, filter bowls, rigid food containers, closures, pencil barrels, battery cases, computer tape reels and automobile speedometer lenses.

TYRIL 760 resin displays easy flow characteristics along with good resistance to environmental stress cracking. It has high heat resistance and a good balance of physical properties.

TYRIL 767 has an excellent balance of physical properties, good resistance to environmental stress cracking, high heat resistance and moderate toughness.

TYRIL 770 has a good balance of physical properties, good high heat resistance, and moderate toughness. It contains an ultraviolet stabilizer. Typical applications are internal automobile parts, such as speedometer lenses, and indoor signs.

TYRIL 780 has a very high level of chemical and heat resistance, and exhibits greater strength properties than are usually found in copolymers of this type.

TYBRENE® acrylonitrile-butadiene-styrene

TYBRENE acrylonitrile-butadiene-styrene (ABS) resins are outstanding for their toughness over a wide temperature range. In addition, TYBRENE exhibits hardness, rigidity, excellent chemical resistance and good dimensional stability. TYBRENE resins may be injection molded, extruded, or vacuum formed, and are easily decorated.

Suggested end uses for these products include appliance housing, ladies' shoe heels, pipe, telephone hand sets, and luggage shells. In addition, TYBRENE finds many uses in the automotive and refrigeration industries.

TYBRENE 213 is especially formulated for the manufacture of extruded refrigerator parts which require toughness, stress crack resistance, ease of fabrication and good thermal stability during sheet glazing.

TYBRENE 1217 is designed for injection molding applications such as the manufacture of automotive components and refrigerator breaker strips. It is easy flowing and produces good surface gloss when processed in hot molds.

TYBRENE resin formulations designed for many other applications are in development by Dow, and will be added to the product line as they reach a high degree of sophistication. These will include resins with extremely high impact strength, extremely good chemical resistance, and others tailored for specific uses.

plastic-clad metals

ZETABON® plastic-clad metals, specialty products designed for use in the manufacture of electrical cable shields, are among Dow's newest products. They consist of metal substrates extrusion-coated with a special adhesive polyethylene copolymer.

When used in the manufacture of communication cables, ZETABON products increase the strength and durability of the finished product, eliminate moisture penetration and prevent corrosion of the shield. This is accomplished by the resulting sealed lap seam and the bonding of the outer jacket to the shield.

The product designated as ZETABON A280 shield is an eight mil aluminum substrate coated one-side with two mils of Dow's special adhesive polyethylene. The one designated ZETABON C250 shield is a five mil copper substrate coated one-side with two mils of polyethylene, and the one designated ZETABON C252 shield is the same copper substrate coated two-sides.

Various substrate materials are being used in producing developmental plastic-clad metal products. These will be made available as new uses develop.

polypropylene

Dow polypropylene resins are produced by a unique process which yields materials of exceptional purity, stability and uniformity.

Polypropylene has the lowest specific gravity of all thermoplastics and exhibits a remarkable range of properties in molding and extrusion applications. It withstands temperatures of over 250 °F., resists attack by most solvents and chemicals, resists abrasion, and when properly fabricated has phenomenal flex life due to its natural "hinge-action."

Dow polypropylenes may be classified by melt flow into four main categories. A fifth category is made up of those Dow polypropylenes which are classified as impact grades.

In general, Dow Polypropylenes in the "200" series are stiff flowing; those in the "300" series are moderately easy flowing; and those in the "700" series have very easy flow.

Within each of these melt flow groups, modifications are made to produce resins with tailored physical and chemical properties.

Dow Polypropylenes 200, 300 and 700 are general purpose resins. Dow Polypropylenes 201, 301 and 701 meet all FDA requirements.

Those Dow Polypropylene resins designated 202, 233, 302 and 702 are resistant to sustained heat environments.

Dow Polypropylenes 230, 330, and 730 are controlled crystallinity resins. Dow Polypropylenes 231, 331, and 731 are controlled crystallinity resins which meet FDA requirements.

Ultraviolet stabilizers are added to Dow Polypropylenes 205 and 305 to produce formulations which are resistant to long-term exposure to light.

Dow Polypropylene is supplied in three impact grades. M-40 is medium impact, H-60 is high impact, and S-80 is extra high impact. Polypropylenes find applications in such products as film, bristles, fiber, major household appliances, packaging items (primarily closures), automotive parts, housewares, medical accessories, toys, luggage and furniture.

ethylene copolymers

ZETAFIN® is the trademark given by Dow to its family of ethylene copolymers. These ethylene-ethyl acrylate and ethylene-vinyl acetate copolymers are soft, highly flexible resins with end use characteristics similar to vinyl. They have excellent thermal stability during fabrication and require no plasticizers or compounding.

Ethylene-Ethyl Acrylate. ZETAFIN 30 resin is a low melt index material offering excellent physical characteristics and good stress crack resistance.

Ethylene-Vinyl Acetates. ZETAFIN 120 resin is a low melt index material offering improved low temperature properties and flexibility while retaining good stress crack resistance. ZETAFIN 150 resin is a low melt index material with excellent toughness and flexibility and excellent stress crack resistance. Both products exhibit a good balance of physical properties and both meet the requirements of FDA regulations.

Among the end uses which utilize their excellent outdoor weathering characteristics are wire and cable applications. Other uses exploit the products' flexibility: tubing and hose; flexible toys such as dolls; squeeze bottles; place mats, draperies and table cloths; also protective end caps, gaskets and bumpers.

polyethylene

Dow polyethylenes, produced in low and high densities, as well as special formulations, are available in nearly five dozen combinations of chemical and physical properties.

Polyethylene has a particularly useful profile of properties. Without plasticizer addition, it is flexible and tough through a range of temperatures from over 200 °F. to -25 °F. It has one of the lowest specific gravities of commercial thermoplastics.

It is remarkably inert to corrosive solutions. Its toughness, clarity and moisture barrier properties make polyethylene ideally suited to film applications. Its excellent dielectric characteristics make it extremely well-suited for application to wire and cable manufacturing.

Low Density Film Extrusion Resins. Dow polyethylenes are supplied in 21 low density formulations designed for film extrusion. These resins range from 0.45 to 8.0 in melt index and from 0.916 to 0.934 in density. Over half are furnished with anti-block additives incorporated.

Low Density Blow Molding Resins. Two Dow polyethylene resins specifically tailored for blow molding are available in low densities. Dow polyethylene 200B has a melt index of 0.7 and a density of 0.924. Dow polyethylene 400B has a melt index of 1.6 and a density of 0.920.

Low Density Molding Resins. Dow polyethylenes are furnished in 15 formulations designed for injection molding. These resins range from 1.5 to 35.0 in melt index, and their densities range from 0.917 to 0.926.

High Density Resins. Dow polyethylenes are available in nine high density formulations.

Six of these formulations are homopolymers with melt indexes ranging from 0.25 to 5.0, and densities ranging from 0.953 to 0.9629. The homopolymer formulations are designated Dow Polyethylenes RH2701, RH2702, RH2703, RH4401, RH5401, and RH0501.

Two Dow polyethylene copolymer resins, designated RC0201 and RC1601 are available. Their melt indexes range from 0.25 to 1.0, and their densities range from 0.947 to 0.9599.

One other formulation, designed for a specific type of fabrication is also available. Dow Polyethylene RS1901, available only in yellow, has a melt index of approximately 0.60 and a density of approximately 0.970.

Wire Coating Resins. Six Dow Polyethylenes, PE808, PE813, PE818, PE853, PE864 and PE869, are designed for extrusion of wire coatings in the wire and cable industry. These resins range from 0.2 to 0.4 in melt index, and from 0.918 to 0.931 in density.

Dow Polyethylenes 808, 813 and 818 are available in natural only, and are intended primarily for communication and power cable insulation. The remaining resins are furnished only in black; they are intended for use in cable jacketing and line wire coverings.

coatings products

The coatings products of the Plastics Department are of three general types—monomers, latexes, and resins. The listing of specific products should not be considered complete. Many experimental products and specially tailored products not listed are supplied to customers. The brief discussion of applications after each sales product only indicates its major area or areas of use. Most latexes and resins have many uses and complete families of latexes are available—especially formulated to meet specific needs of major industries in which they are used.

monomers

Monomers are the molecular building blocks which—under controlled conditions—enable the design of polymer and copolymer plastics, latexes, and resins. Dow monomer products include:

Styrene	Divinylbenzene
Vinyltoluene	Vinylidene Chloride
α-Methylstyrene	

They are manufactured from readily available raw materials. Large, nationwide manufacturing and distribution facilities assure Dow customers of continuing supply and service.

The greatest uses of monomers are in the production of plastics and in synthetic rubber manufacture.

However, certain other uses should be emphasized. For example, styrene and vinyltoluene have important utility as crosslinking agents for polyesters in various reinforced plastics and coatings. They also are used to modify the properties of drying oils and alkyds. Divinylbenzene is used in the manufacture of ion exchange resins, and vinylidene chloride is finding increasing volume in special copolymer compositions.

latexes

Latexes are polymer or copolymer particles dispersed in water. They are important to industry primarily as binders and saturants.

Building Products Latexes. The Dow Latex 400 series is designed to meet specific binder requirements for the building products industry. These latexes are compatible with highly alkaline portland cement and improve such physical properties as bond strength, compressive strength, tensile strength, and flexural strength.

Dow Latex 460 styrene-butadiene-latex-modified portland cement mortars have gained such a reputation for unmatched performance in interior applications and rugged durability in exterior pigments that they are considered the standard of the industry. Dow Latex 464, a Saran[†] latex, is offered as a companion product for those applications requiring maximum strength, solvent resistance and bonding properties.

Foam Product Latexes. Specially designed Dow latexes can be formulated to yield rubbery cushioning latexes by a variety of chemical and mechanical processes. Foamed latex systems are particularly useful when coated directly onto decorative or functional substrates. Applications include cushion-backed rugs and carpets, separate carpet underlayment, automotive trim padding, clothing, etc.

Dow Latex 900 is a high styrene latex for modification of rubber latexes to achieve higher modulus. The resultant latexes are processed by traditional latex foam processes employing vulcanization chemistry.

Dow Latex 902 is a new carboxylated styrene-butadiene product available for processing under license of Dow's U. S. Patent 3,215,647. The foams resulting from Dow Latex 902 are superior in initial color, aging stability, adhesion, breadth of possible densities, and simplicity of processing. Dow Latex 902 is the first of a planned Dow family of carboxylated latexes which do not require vulcanization in curing to foams with new property advantages.

Paint Latexes. The design of synthetic latexes for use as paint binders is a result of research and development work carried to success by The Dow Chemical Company. The first products having commercial success were useful in interior flat trade sales finishes. In cooperation with paint manufacturers, Dow has since been instrumental in opening up the fields of interior and exterior masonry paint, industrial finishes, maintenance finishes, and intumescent finishes to latex paint systems. New business and new markets for paint have stemmed from this work.

Styrene-butadiene latexes are widely used in the interior trade sales field and offer several important advantages to the paint manufacturer. These include excellent binding properties, exceptional product uniformity, and relatively low specific gravity with its resultant cost savings. The resistance of styrene-butadiene latexes to highly alkaline surfaces has resulted in their widespread use over exterior and interior masonry surfaces and in concrete floor finishes. Their compatibility with a host of paint ingredients means cost savings and versatility in formulation.

Dow Latex 300 is a uniquely designed styrene-butadiene latex that gives maximum flow and leveling with the use of synthetic thickeners. Dow Latex 300 permits formulation of interior flat wall paints with maximum hiding efficiency. Dow Latex 305 is used in interior flat systems and in masonry paints applied over stucco, brick, asbestos cement shingles, concrete block, and cinderblock. Prime characteristics of masonry paints made with this latex include high resistance to leaching, efflorescence, and water spotting.

Dow Latex 307 is the standard styrene-butadiene latex that manufacturers have relied on for years. It is recommended for use in topcoats, primers, sealers and texture paint formulations. It exhibits superior scrub resistance, pigment binding power, color acceptance, and alkali resistance.

Acrylic latexes made by Dow have broad use in latex paints.

Dow Latex 352 acrylic latex is used in primer and topcoat formulations over both new and previously painted wood. Paints made with Dow Latex 352 will withstand extremes of temperature and moisture and the dimensional changes which these cause in wood.

Prototypes of Dow Latex 354 have provided outstanding wet adhesion, resistance to grain line cracking and blister resistance after over 3 years' exposure in Freeport, Texas and Midland, Michigan. This latex provides excellent durability in exterior house paints for both wood and masonry surfaces.

Dow Latex 358 is the first commercially available acrylic latex, with five years of proven performance in industrial maintenance applications. Paints formulated with Dow Latex 358 are characterized by high gloss retention, outstanding chalk and corrosion resistance, and excellent adhesion to most metal surfaces.

Paper Latexes. The Dow Latex 600 series contains several well-known items used as pigment binders in the coated paper and paperboard industry. These

[†]Dow trademark abroad

binders offer advantages in the application of the coating and impart improved printability to the finished stock. The 600 series currently consists of Dow Latex 611, 612, 630 and 636. In addition, several experimental and special purpose latexes are available.

Textile Latexes. The Dow Latex 800 series is designed to meet the complete range of physical property and processing requirements of the textile and related industries. Each latex possesses unique characteristics. Current applications include tufted and woven carpet backsizing and scrim laminating, fabric sizing and stiffening agents, binder for textile pigmented compositions, binder for animal and fiber pads, shoe industry adhesives and strengthening agents, saturant for non-woven fabrics, saturant and sizing for fiberglass rovings, coatings for felt, burlap, rubber floor mats, tape backings, etc., binder for scrap urethane foam, and specialty adhesive applications.

PRODUCT NAME	DESCRIPTION
(Styrene-Butadiene Latexes)	
Dow Latex 813	—Self-cure, no antioxidant.
Dow Latex 814	—Self-cure, no antioxidant.
Dow Latex 815	—Self-cure, contains an antioxidant.
Dow Latex 840	—Self-cure, contains an antioxidant.
Dow Latex 842C	—Self-cure, contains an antioxidant.
Dow Latex 859H	—High solids version of Dow Latex 859.
Dow Latex 862	—Non-self-cure, no antioxidant.
Dow Latex 863	—Dow Latex 862 plus antioxidant.
Dow Latex 864	—Non-self-cure, no antioxidant.
Dow Latex 880	—Self-cure, contains an antioxidant. Exceptionally high filler acceptance.
(Polystyrene Latex)	
Dow Latex 860	—Contains no antioxidant.
(Vinyl Latexes)	
Dow Latex 870	—Polyvinyl chloride.
Dow Latex 874	—Vinyl chloride/vinylidene chloride copolymer.
(Acrylic Latexes)	
Various types available.	

resins

Coating resins are those synthetic polymer particles designed to be applied either out of a solvent solution or by use of heat and pressure.

Saran† Resins. Because they are excellent barriers to moisture, moisture vapor, and gases, and to greases and oils, these resins are widely used as functional coatings on paper, paperboard, cellophane and plastic films. They provide added protection, gloss, abrasion resistance and heat sealability. Their chemical resistance is utilized in corrosion resistant lacquer coatings for metal structures.

PRODUCT NAME	APPLICATIONS
Saran Resin F-120	—For chemical and corrosion resistant coatings.
Saran Resin F-220	—For transparent film and paper coatings.
Saran Resin F-242L	—For low MVT coatings and excellent chemical and solvent resistant coatings.
Saran Resin F-216	—For low MVT coatings and improved adhesion over F-242L.

Polystyrene Resins. The Dow polystyrene resins are employed in asphalt floor tile, in press-polish coatings for wood substrates, and in label lacquers. In the paper industry they are used as lacquers to transparentize, and as hot melts to increase the dimensional stability of paper.

†Dow trademark abroad

PRODUCT NAME	APPLICATIONS
Dow Resin PS-2	—Low viscosity resin for above uses.
Dow Resin PS-3	—Higher viscosity version.

Epoxy Resins and Curing Agents. These thermosetting polymers are noted for their hardness, toughness, dimensional stability, resistance to solvents and chemicals, and low cure shrinkage.

TRADEMARK NAME	APPLICATIONS		
Liquid Resins			
D.E.R.® 321 D.E.R. 330 D.E.R. 331 D.E.R. 332 D.E.R. 332-LC D.E.R. 334 D.E.R. 335 D.E.R. 336 D.E.R. 337	A wide range of viscosities for plastic tooling, reinforced plastics, electrical potting and insulating materials, adhesives, coatings and concrete resurfacing.		
Solid Resins			
D.E.R. 660 D.E.R. 661 D.E.R. 662 D.E.R. 664 D.E.R. 667 D.E.R. 668 D.E.R. 669			
Solid Resin Solutions			
D.E.R. 337-X90 D.E.R. 661-A75 D.E.R. 661-A80 D.E.R. 661-PR-A80 D.E.R. 661-EK75 D.E.R. 667-EAX55 D.E.R. 670-MK75 D.E.R. 670-T75 D.E.R. 670-X75 D.E.R. 670-XM75 D.E.R. 671-MK75 D.E.R. 671-T75 D.E.R. 671-XM75 D.E.R. 672-XM70 D.E.R. 684-EK40 D.E.R. 686-EK40		Solvent solutions of epoxy resins designed for standard and custom end uses.	
Flexible Resins			
D.E.R. 732 D.E.R. 736 D.E.R. 741			
Flame Retardant Resins			
D.E.R. 511 D.E.R. 511-EK80 D.E.R. 511-A80 D.E.R. 534 D.E.R. 534-T75 D.E.R. 542 D.E.R. 580			Potting and reinforced plastics where flame retardance is needed.
Epoxy Novolacs			
D.E.N.® 431 D.E.N. 438 D.E.N. 438-A85 D.E.N. 438-EK85 D.E.N. 439 D.E.N. 439-EK85			
Epoxy Curing Agents			
D.E.H.® 10 D.E.H. 11 D.E.H. 12 D.E.H. 14 D.E.H. 20 D.E.H. 24 D.E.H. 25 D.E.H. 31 D.E.H. 32 D.E.H. 33 D.E.H. 50 D.E.H. 52 D.E.H. 61	A variety of polyamines, polyamides, and adducts suitable for curing epoxy resins for a wide number of applications.		

A variety of polyamines, polyamides, and adducts suitable for curing epoxy resins for a wide number of applications.

Dow Polyethylene CG Resins. These resins are specially designed to meet commercial extrusion coating requirements over paper, paperboard, foil and film. They contribute gloss, heat sealability, grease resistance and moisture-barrier properties to the substrates.

The low odor and low-temperature flexibility of Dow polyethylene give it wide use as a protective packaging material for food.

The product numbers reflect density in the first two digits and melt index in the latter digits.

PRODUCT NAME	APPLICATIONS
Dow Polyethylene CG1608	For high speed application and low coating thickness with good adhesion and barrier qualities.
Dow Polyethylene CG1612	For high speed application and low coating thickness with excellent heat sealability and adhesion.
Dow Polyethylene CG1705	Multipurpose resin for range of weights and coating speeds. Many uses in flexible packaging.
Dow Polyethylene CG1705-B	Same as CG1705 with 2.5% carbon black added. For applications requiring good weathering properties.
Dow Polyethylene CG1902	For medium to heavy coating weights, minimum neck-in. Strongest and toughest of low density series.
Dow Polyethylene CG2503	For medium density improvement of low permeability, hardness and slip, good extrusion characteristics.
Dow Polyethylene CG3002	For applications requiring improved barrier properties. Has excellent extrusion characteristics.

DERAKANE® vinyl ester resins. A new family of thermosetting resins specifically designed for the reinforced plastics industry. These resins are styrene-diluted and peroxide-initiated, and are characterized by low viscosity and low molecular weight. Variations of the basic resins are adaptable to matched metal molding, lay up—spray up, filament winding, and other processing techniques used in the reinforced plastics industry.

TRADEMARK NAME	APPLICATIONS
DERAKANE 118	Mat or preform matched metal molding for high filler loadings and greatly reduced stress cracking.
DERAKANE 114	Same as DERAKANE 118 with improved surface finish and extremely fast cure capabilities.

ZETAFAFAX® ethylene copolymer resins are new high-molecular-weight plastics. They are characterized by a high degree of compatibility with both microcrystalline and paraffin waxes, and they impart improved properties to those low cost waxes which are used as hot melt coatings and adhesives.

TRADEMARK NAME	DESCRIPTION
ZETAFAFAX 1070	Ethylene/Ethyl Acrylate Copolymer containing 20% comonomer. 2-3 melt index resin.
ZETAFAFAX 1075	Same as 1070 except has 18 melt index.
ZETAFAFAX 1170	Ethylene/Ethyl Acrylate Copolymer containing 30% comonomer. 2-3 melt index resin.
ZETAFAFAX 1175	Same as 1170 except has 18 melt index.
ZETAFAFAX 1270	Ethylene/Isobutyl Acrylate Copolymer containing 20% comonomer. 2-3 melt index resin.
ZETAFAFAX 1275	Same as 1270 except has 18 melt index.
ZETAFAFAX 1278	Same as 1270 except has 250 melt index.
ZETAFAFAX 1370	Ethylene/Isobutyl Acrylate Copolymer containing 30% comonomer. 2-3 melt index resin.
ZETAFAFAX 1375	Same as 1370 except has 18 melt index.
ZETAFAFAX 1570	Ethylene/Vinyl Acetate Copolymer containing 27% comonomer. 5 melt index resin.
ZETAFAFAX 1575	Same as 1570 except has 15 melt index.

ETHOCEL® ethylcellulose, with its excellent heat stability and low-temperature properties, is tough, flexible, alkali resistant, and soluble in alcohols and aromatic hydrocarbons. ETHOCEL is used in hot melt strippable coatings, where its toughness and impermeability make it a unique package for machined and precision parts.

ETHOCEL is also used in gel lacquers for applications which require extreme abrasion and scuff resistance and where extremely heavy coatings in a single dip operation are needed. It is employed as a modifying resin in automotive, furniture, and similar conventional lacquers, and in various adhesives and film and paper coatings.

TRADEMARK NAME	APPLICATIONS
ETHOCEL, Medium (Ethoxyl) and Standard (Ethoxyl)	For all above applications.

Electroconductive Resins. Dow is currently developing a family of resins which are specifically designed to impart electroconductivity to base papers which ultimately are used in electrostatic reimagining processes. Although these materials are currently used in paper substrates only, it is believed they have broader utility and might find application for such uses as destaticizers in textiles, etc.

plasticizers

In addition to latexes and resins, Dow offers for sale a number of plasticizers. Dow Plasticizer 5 is utilized for plasticizing ethylcellulose, vinyl ester resins, nitrocellulose, polystyrene latexes and—in combination with such plasticizers as phthalates and sebacates—in calendared vinyl films. Dow Plasticizer 1099 is excellent for cellulose. Dow Resin 565 is a plasticizer for lacquer, adhesives, melts, and plastics, while Dow Resins 276 V-2 and 276 V-9 are used for plasticizing ethylcellulose, polyvinyl chloride, hot melts, varnishes, and alkyds.

construction materials

The design and production of plastic products that meet and anticipate new and existing building and architectural requirements is a major effort of the Plastics Department. In addition to specific products, our endeavor is to develop a "systems concept" which will provide users with assurance that the products, in combination with other materials, will perform as desired.

Miller System. The use of STYROFOAM® FR brand insulation, DORVON® FR molded polystyrene foam or THURANE® FR rigid urethane foam board with the new Dow Insulation Mastic #7 high tack adhesive provides quality insulation and a simple, fast method of bonding the interior gypsum wallboard finish to the foam insulation in masonry construction. Systems for adhering plywood and other wallboards are also available. Dow Insulation Mastic #7 is also applicable for adhering the foam insulation to the masonry wall, replacing the use of portland cement mortars.

STYROFOAM RM Insulation and Coated Base Sheet System. The use of this insulation and the coated base sheet achieves a quality roofing system which assures dry insulation and eliminates water pickup by the first layer of roofing felt.

Dow Insulating Panel System. Custom and standardized building panels have a core of flame-retardant STYROFOAM insulation bonded to sturdy skins and are equipped with a unique Cam-lock device. The panels are designed for quick, low cost and permanent erection of low temperature structures such as walk-in coolers or freezers, weatherable outside buildings and liners for existing rooms. Standard panels are 4 feet

by 8 feet, in thicknesses of 2, 3, 4, 6 and 8 inches. Lengths of 8 feet to 24 feet in 2-foot increments and varying widths are also available.

Thin Shell System. The use of insulating boards of STYROFOAM FR as form liner and permanent insulation base for concrete in thin shell hyperbolic paraboloid roofs is an advanced concept eliminating much conventional false work and form work.

STYROFOAM FR is used widely as comfort and low temperature insulation. Typical building applications include thermal insulation for refrigerated warehouses, coolers, freezers, trucks, trailers, ships, railroad cars; insulation base for plaster and wall-board masonry construction; core material in sandwich panel construction; and covering for low temperature pipes and equipment. A new application involves the use of STYROFOAM insulation as a form in the construction of thin shell roofs.

STYROFOAM FR is flame-retardant. Standard sizes are 16 inches wide, 4 1/2 feet long, and 1, 1 1/2, 2, 3, and 4 inches thick.

STYROFOAM SB perimeter insulation board is designed specifically for perimeter and foundation applications in both residential and commercial construction. It is made from polystyrene plastic, expanded about thirty-five times into a tightly-knit uniform structure of small, closed cells. It is available in sheets: two feet wide by eight feet long, thicknesses ranging from 3/4" to 2".

Each board is prescored and marked to facilitate snapping along its entire length at 6, 12 and 20 inches from one side.

Because of its closed-cell structure, STYROFOAM SB provides outstanding insulation effectiveness, high resistance to the passage of water and water vapor, and long service life. STYROFOAM SB insulation is non-irritating to the skin and extremely resistant to rot, mold or decay. It weighs less than 3.0 pounds per cubic foot, allowing easy handling in large pieces and rapid installation. STYROFOAM SB easily carries the compressive loads encountered in standard applications. Its outer skin of dense, smaller-cell-size polystyrene gives it impact resistance and toughness.

Flame-retardance is an additional benefit.

STYROFOAM RM Roof Insulation is designed specifically for insulation under built-up roofs. It is composed of a 2' x 4' board of extruded, expanded polystyrene. The boards have a high density skin of expanded polystyrene and incorporate the use of an asphalt coated base sheet as the first ply of the built-up roofing. This coated base sheet is laid dry on the STYROFOAM RM at the job site and utilizes the heat from successive layers of asphalt to give bond to the insulation board. A coated base sheet can be produced on the job with felt-laying equipment.

STYROFOAM RM is available in the following thicknesses:

Nominal Thickness	"C" Value
3/8"	.36
1"	.24
1 1/4"	.19
1 1/2"	.15
2"	.12

STYROFOAM RM insulation boards offer significant savings in insulation costs and these other important properties: permanently low "k" factor; water resistance, reducing need for vapor barriers in water cutoff; light weight—2.5 pounds per cubic foot; ease of application—no handling problems; simplified packaging—eliminates cleanup; strength, providing a firm base for built-up roofing materials.

The boards may be laid over steel decks, poured concrete

and precast concrete panels, poured gypsum and wood decks. Standard built-up roofing materials are then applied in the normal manner or by making use of the coated base sheet system.

STYROFOAM SM insulation boards are intended for use as sheathing for farm applications. They may be applied to new construction or other buildings for the purpose of providing controlled atmosphere for the better growth of farm animals and for sheathing in residential construction.

STYROFOAM FB insulation billet is a flame retardant expanded polystyrene foam in the form of a billet finish planed on four sides. It is used by fabricators in the manufacture of pipe covering or other fabricated pieces where large size billets are required. Billets are 7 inches thick by 14 inches wide by approximately 9 feet long.

STYROFOAM HD 300 insulation is a special high-density foam which is available for applications where unusually high compressive strength is required, such as for freezer-cooler floor insulation, under columns and roof joists, and in other special high-load situations. This material has a compressive strength of 120 psi at 5 percent deflection or yield.

THURANE NB rigid foam boards are made of a polyether-type urethane expanded with fluorinated hydrocarbon. These boards are available in a range of standard sizes to a maximum of 48 inches wide, 16 feet long and 16 inches thick.

These foams have an extremely low "k" factor (less than 0.15 B.T.U. -in./hr. -ft.²-°F.) at 70°F. mean temperature after aging. They also have high strength-to-weight ratio, resistance to water and water vapor transmission, heat distortion of 250°F. and good chemical resistance. THURANE insulation is non-burning.

Important applications for THURANE are in the low temperature insulation field where its low thermal conductivity allows space and weight savings. Insulation in rooms, truck bodies and portable containers are examples. THURANE is also used as a core in panels, in packaging, in buoyancy applications and in various military applications. THURANE is also used as masonry wall insulation for commercial, industrial and residential buildings.

DORVON FR molded polystyrene foam is a flame-retardant, easy-to-handle-and-apply thermal insulation designed for use in the building industry for cavity wall, perimeter, and cold storage room applications. DORVON FR may be used in the Miller system.

DORVON FR brand insulation board, white in color, is available in densities of 1.0 and 1.25 lb. per cubic foot, designated DORVON FR 100 and DORVON FR 125, respectively. DORVON 100 polystyrene foam, a white non-flame-retardant material that is furnished in billets and boards only at a density of 1.0 lb. per cubic foot, is intended primarily for non-construction applications.

SARALLOY® 640R plastic flashing, a new non-plasticized chlorinated polyethylene flashing reinforced with Dacron polyester mesh, offers outstanding weathering and low temperature properties as well as ease of application. The material is pliable and readily conforms to almost any roof or building contour, eliminating the need for prefabrication. Because it is flexible, movement of the flashed joints can occur without failure of the flashing. Sheet sizes and thickness of .045 inches are gauged to application convenience. SARALLOY 640R is classified as non-burning by ASTM D568-61 test method. SARALLOY 640R is easily applied to standard construction materials and can be joined to itself by simple solvent welding. Available in its natural black color, SARALLOY can be painted as required with paint having a base of Hypalon synthetic rubber.

SARALLOY 660 plastic flashing is essentially the same as SARALLOY 640R, but is used for heat-conformable applications. Since it is unreinforced, it is easily conformed to shape by application of heat.

SARALLOY 660 and SARALLOY 640R are used in both new construction and maintenance work as roof and wall expansion joints, base flashings, vent pipe flashings, fascia coverings, shower pan liners, and heavy-duty membrane waterproofing.

SARALLOY 875 chemical resistant sheet is a flexible thermoplastic which has excellent service as a lining material in storage tanks, processing tanks, medium to large diameter pipes and fittings, and fume ducts and hoods.

Plastic Lined Pipe and Fittings. Penton chlorinated polyether lined systems, saran lined systems, and polyethylene lined systems are offered as corrosion resistant products to handle acids, alkalis, salt solutions and solvents which corrode common pipe materials.

These lined products combine the chemical resistance of the plastic liner with the strength of steel pipe. They provide economical piping systems which carry chemicals safely, maintain product purity and resist abrasion by flowing products.

Plastic lined piping is available in common pipe sizes, from one inch to eight inches in diameter, that can be shop and field cut, threaded and installed. Plastic lined fittings, valves and pumps are available in cast iron and steel, completing these piping systems.

MORAF* molded raised faced pipe joints are available from Dow's Bay City Fabrication Department. In addition, tools are available for the field forming of MORAF molded raised faced joints with flanged plastic pipe.

Dow Insulation Mastic #7 is a nonflammable blue mastic having a water carrier. The mastic is designed for bonding STYROFOAM, DORVON and THURANE insulation to masonry and concrete wall surfaces. The adhesive, which turns green after setting, has good initial tack and excellent ultimate bond strength. Dow Insulation Mastic #7 may be used to bond gypsum wallboard directly to STYROFOAM, DORVON and THURANE insulation materials, or any structurally sound, smooth, clean, dry surface.

STYROCRETE® latex formulation is used as an additive for cement mortar to bond plastic foam in comfort and low temperature applications to various surfaces. These surfaces include painted concrete, cured concrete (free of form release agents), brick, block, metal, and tile. STYROCRETE is marketed in five-gallon pails and 55-gallon drums.

STYROTAC® versatile bonding adhesive is designed primarily for use with the Miller system, a technique for applying STYROFOAM insulation board to a masonry wall and gypsum wallboard finish to the STYROFOAM. The excellent initial tack and ultimate bond strength of STYROTAC adhesive eliminates the need for shoring the wallboard and assures a permanent, strong bond.

MASPAC® thermoplastic dump-type packings are designed for gas-liquid contact systems. The packings have been used at Dow since 1954 for stripping volatile solutes from liquid streams in chemical recovery systems, water degasifiers and in fume scrubbers for atmospheric pollution control. MASPAC packings are manufactured in two sizes—3¾ inches and 2 inches in diameter—from several types of thermoplastics, depending on application requirements.

foamed products

These products are plastics that have been expanded into low density materials which contain countless

tiny enclosed cells. They include expanded and expandable polystyrene, expanded polyethylene, and urethane foam.

STYROFOAM expanded polystyrene is polystyrene expanded approximately forty times into a rigid, closed-cell foam having a density range of 1.8-4.5 pounds per cubic foot. STYROFOAM HD300 (ave. 3.5 pounds per cubic foot) is available for applications where higher compressive strength is needed (100 psi min.). STYROFOAM FR insulation is flame-retardant and colored blue for identification purposes. It is intended for construction applications.

STYROFOAM possesses the outstanding properties of structural strength, light weight, resistance to water penetration and moisture vapor transmission, and low thermal conductivity. It will not support mold growth nor attract rodents, and imparts no odor or taste to foods. STYROFOAM is easily fabricated with hand and power woodworking tools, and does not crumble or flake in use.

Because of its desirable properties, STYROFOAM has many applications.

Comfort and low temperature insulation applications are described under "Construction Materials." STYROFOAM expanded polystyrene is used also as a positive flotation material for docks, wharfs, rafts, and in boats for safe buoyancy, and in many novelty, display, floral and packaging applications. STYROFOAM is available in the form of rough planks, cut boards and billets.

STYROFOAM DB decorative billet is intended for floral or decorative applications.

STYROFOAM BB buoyancy billet is used by fabricators of floating equipment, especially floating rafts and docks, as a buoyancy medium. Billets are 7 x 20 inches, 10 by 20 inches, and 10 by 24 inches by approximately 9 feet long.

Other expanded polystyrene products, designated STYROFOAM SB, STYROFOAM SM, STYROFOAM RM, and STYROFOAM FB, are listed under "Construction Materials."

PELASPAN expandable polystyrene beads or pellets are available in regular or flame-retardant form and are foamed in place by the user into almost unlimited shapes and sizes. For further information, see listing under "Molding and Extrusion Materials."

PELASPAN-PAC expandable polystyrene strands for loose-fill packing will not mat down, dust, or attract rodents or vermin when stored. They have superior cushioning value with favorable cost economics.

ETHAFOAM® lightweight, low density polyethylene foam is formed by expanding Dow polyethylene until it is approximately thirty times lighter in weight than water. It is a unique flexible closed-cell material having excellent resistance to chemicals. It also has excellent energy absorption under impact, low water absorption, low water vapor transmission, good insulation value, no odor, and is easily fabricated.

These properties suit ETHAFOAM polyethylene foam for a variety of applications, some of which are:

Buoyancy material	Shock absorption
Cushion Packaging	Thermal insulation
Seals and gaskets	Toys, novelties, displays

ETHAFOAM is available in the form of large and small round rods, sheets and tubes, ovals and wide untrimmed planks, all at a density of approximately two pounds per cubic foot.

TYRILFOAM® 80 expanded styrene-acrylonitrile is a product tailored for flotation uses under conditions

*Trademark

of gasoline spillage, petroleum scum from outboard motors, and stagnant water. TYRILFOAM has good gasoline resistance. It is sold as buoyancy billets in several sizes and also available in boards. TYRILFOAM 80 is also being used in packaging applications. The product has the same buoyancy factor as Styrofoam expanded polystyrene—55 pounds per cubic foot.

THURANE NB rigid urethane foam board is a polyether-type urethane expanded with fluorinated hydrocarbon. The boards are available in a range of standard sizes to a maximum of 48 inches wide, 16 inches long and 16 inches thick.

This foam is characterized by an extremely low "k" factor (less than 0.15 B.T.U. -in./hr. -ft.²-°F.) at 70°F. mean temperature after aging. It also has high strength-to-weight ratio, resistance to water and water vapor transmission, heat distortion of 250°F., good stability under high humidity conditions, and good chemical resistance.

Important applications for THURANE are in the low temperature insulation field where its low thermal conductivity allows space and weight savings. Insulation in rooms, truck bodies and portable containers are examples. THURANE urethane board is also used as a core in panels, in packaging, in buoyancy applications and in various military applications.

THURANE insulation is non-burning.

PACKAGING PRODUCTS

The Packaging Department of The Dow Chemical Company markets materials which are used by other manufacturers to contain, support, or protect their products. These packaging materials include blow molded or thermo-formed rigid plastic containers, clear or printed films, bags and pouches and roll stock combinations of film, foil and paper.

laminated and coated materials

METALAM®. Any of more than 500 different combinations which include aluminum foil are sold under the trademark METALAM. Formulated for high-speed automatic packaging, METALAM provides a flexible packaging medium of exceptional protective qualities and sales appeal. Packages made from the material can be opened quickly and easily by hand. METALAM is moistureproof, greaseproof, puncture-resistant, and of low toxicity. METALAM can be formulated for specific packaging needs, depending on the size and shape, weight, physical characteristics and end use of the product to be packaged. Combinations which give perishable food products shelf life of a year or more without refrigeration are routine. METALAM is used to package such widely differing products as tomato sauce and dry soup mixes, throat lozenges and surgical sutures, freeze-dried meat and after-shave lotion.

DURAFILM®. There are also more than 500 available combinations of DURAFILM multi-ply transparent film. POLYFILM® polyethylene, saran, cellophane, cellulose acetate and polyester are a few of the films used in DURAFILM, which offers most of the qualities of METALAM, plus transparency. Products which are not affected by exposure to light, but which are enhanced by visibility and can be packaged automatically are most often packaged in DURAFILM. Sliced meats and cheese, nut meats, shampoo, liquid shortening and candy are a few of these products.

Paper Specialties. Combinations of papers and plastic films or coatings which offer protection for such products as dehydrated baby cereals, cake mixes, soft drink mixes and soap and detergent powders are available from Dow.

ZIP-TAPE® opening tape is a cellophane or polyester film product, made by slitting colored or coated film, or by laminating two layers of film together and then slitting. It is available in a wide range of colors, widths and thicknesses. It is an easy-opening device for any package or bag which is overwrapped in cellophane, paper, TRYCITE® film or acetate. Attachments which will apply it to any of these materials as an integral part of a package are available for nearly every modern packaging machine. It can be applied running from top to bottom or along the girth, at any elevation, of any package.

converted films

Dow converted films include all types of flexographic and gravure-printed plastic film as well as custom and stock-printed polyethylene bags.

SARAN WRAP-S* film is a copolymer based on vinylidene chloride and vinyl chloride, biaxially oriented for a high degree of shrinkability in both directions. Dow fabricates bags and casings in a wide range of sizes, both plain and printed. SARAN WRAP-S is processed to incorporate the outstanding characteristics of SARAN WRAP — unexcelled transparency, sparkle, gloss and protective properties—with the high shrink energy and toughness required by the normal methods of packaging in the material. The gas and water vapor transmission rates of SARAN WRAP-S are extremely low, and it has excellent resistance to acids, alkalies, oils and organic solvents. Its low temperature flexibility completes its value as a packaging medium for turkeys and other frozen fowl, in a process whereby bags are shrunk to the contours of the bird being packaged in a quick hot water bath. Processed and ring meats, fish and bulk cheeses are other items which receive maximum protection from shrinkable Saran.

film and sheeting

SARAN WRAP*. A copolymer of vinylidene chloride and vinyl chloride, SARAN WRAP plastic film is characterized by high transparency, very low water vapor and gas transmission, excellent chemical resistance, and heat shrinkability. SARAN WRAP is a widely used food packaging film by industrial packagers and by householders. Products requiring a high degree of protection such as natural cheese and processed meats are commonly seen in SARAN WRAP.

The film is suitable for use on a variety of packaging machines including overwrappers and the types that form, fill and seal the package. It is heat sealed on the overwrap type of package and electronically welded on the tube and bag type packages. Other films and papers are often laminated to SARAN WRAP to increase the usefulness of both materials. Typical of these laminates is the capliner, a combination of SARAN WRAP film and paperboard used as the seal in bottle caps. Among stock products, Dow also includes rolls of SARAN WRAP, for use in hand-packaging operations at store or institutional feeding levels. SARAN WRAP is available in these put-ups: (1) Cutter-Box-Rolls—1,000-foot rolls, available in 12- and 18-inch widths and 40- or 50-gauge thicknesses, in self-dispensing boxes; and (2) Dispenser Rolls—2,000-foot rolls, available in 9-, 10-, 12- and 18-inch widths and 40- or 50-gauge thicknesses, for use in inexpensive dispensers.

POLYFILM is Dow's trademark for virgin polyethylene film specially formulated and manufactured for converting and packaging and for various industrial uses. POLYFILM offers the typical polyethylene properties of toughness, low temperature flexibility, low water vapor transmission and high gas transmission. Various types of POLYFILM are supplied, permitting selection of the appropriate combination of strength, clarity, gloss, slip, and colors for different uses. A number of film constructions are offered including

*Trademark

flat sheeting, centerfold sheeting, flat and gusseted tubing. Also, special surface treatment for improved ink adhesion is optionally available.

Typical uses are food packaging, shrouds and covers, skin packaging, textile wraps, and separator sheets. As a packaging material, this film is used directly by packagers or is processed by converters who perform printing and/or fabrication to provide an end use package.

TRCYTE oriented polystyrene film is noted for its clarity, dimensional stability, high area coverage, and low cost. Film properties include a moderate moisture vapor transmission rate and a high gas transmission rate.

Packaging applications include produce overwrapping and use as a window material in envelopes and folding cartons for a wide variety of products.

formed containers

Plastic packages in stock or custom designs are sold under the trademark **DOWPAC®**. These packages include formed containers, lids and trays.

Formed Containers and Lids. These thermoformed plastic packages are suitable for dairy products and other foods. They are dimensionally stable and may be filled and capped on high speed automatic equipment. Inset cover-all plastic lids provide a watertight seal, yet permit venting of the contents.

Containers and lids may be either stock or custom printed and are available in six colors and in 8-oz. squat, 8-oz. semi-tall, 12- and 16-oz. tall, 32-oz. super squat, 32-oz. squat, and 32-oz. tall sizes.

Meat Trays. These sparkling white trays are used to pre-package retail cuts of meat. Besides enhancing natural meat color, they have great consumer appeal, are available in many sizes and may be used on conventional wrapping equipment.

Apple Trays. Available only in the Washington state apple producing area, these trays, as part of a master container, protect apples en route to the retail stores.

blown containers

Polyethylene. Blow molded containers are manufactured and marketed for food applications and for packaging household products such as liquid bleach, all-purpose detergents, fabric conditioners, ammonia, starches, floor waxes and cleaners, automotive polishes and other products, and for cosmetics and toiletries.

Special emphasis is placed in development and production of private designs.

Blow molded plastic bottles for household and non-food applications are available in a variety of stock designs in matched sets in 32-, 64-, and 128-oz. sizes with integral handles. Certain container designs without handles are also available in pint and quart sizes.

Blown bottles for food applications are available in a variety of stock designs in quart, one-half gallon, and gallon sizes.

PVC. Development of PVC blown bottles has been made with limited production available. These containers are suited for cosmetic, toiletry, and certain household product applications.

METALS

The Dow Chemical Company is a producer of primary magnesium and a manufacturer of aluminum and magnesium mill products. Dow produces magnesium

from sea water at its Freeport, Texas, plant which has a rated capacity in excess of 120,000 tons annually. Aluminum and magnesium mill products are manufactured in a large, well equipped plant in Madison, Illinois. The building, with a floor area totaling approximately forty acres, houses seven rolling mills and seven extrusion presses including one with a 14,000-ton capacity. This is one of only three such presses operating in the free world and the only one producing both aluminum and magnesium extrusions.

The paragraphs which follow describe the various products offered for sale through the Metal Products Department of The Dow Chemical Company. Since Dow is constantly expanding its production facilities, products not listed may become available at any time and should, therefore, be made the subject of special inquiry.

aluminum products

The standard aluminum alloys and the mill products normally produced in these alloys are manufactured and sold to the "Standards for Aluminum Mill Products" issued by The Aluminum Association, unless otherwise agreed upon with the customer. Commodity items intended for specific uses conform to accepted commercial quality for these items or are as agreed upon with the customer.

The aluminum mill products listed in the paragraphs which follow are typical of those currently produced. Information on any products not listed will be furnished upon request.

Aluminum Sheet and Plate Products. Aluminum flat or coiled sheet and plate products are produced in gauges ranging from 0.006 inches up and in a variety of alloys, tempers and sizes. Plate is supplied in some heat-treatable and all non-heat-treatable aluminum alloys. Sheet products are manufactured only in the non-heat-treatable alloys.

Sheet and Plate
Armor Plate
Coiled Foil Stock
Coiled Reroll Stock

Residential Siding Stock
Coiled Weatherstrip Stock
Coiled Fin Stock
Railroad Car Stock

Extruded Aluminum Products. The aluminum extruded products listed below are produced in both heat-treatable and non-heat-treatable alloys. The available lengths of extrusions range from 45 feet on the standard presses to 90 feet on the 14,000-ton press.

Rod, Bar and Solid Shapes
Hollow Shapes
Structural Shapes
Tube
14,000-Ton Press Extrusions

Pipe
Ballistic Extrusions
Forging Billet
Electrical Bus Conductors
Tube Stock

magnesium products

Magnesium alloy products are made to Dow Product Standards which meet government and national society specifications, or are as agreed upon with the customer.

The available alloys, tempers and sizes for the various magnesium products are too numerous to list here. Complete information on any of these products will be furnished upon request.

Primary Magnesium. Supplied in the form of pigs, ingots, extruded sticks and turnings as shown in the following table:

FORMS OF PRIMARY MAGNESIUM

Form	Dimensions —inches	Weight —pounds
Self-Palletizing Pig	8¼ x 2½ x 32½	42
4-piece Notched Ingot	4¼ x 4¾ x 28	20
Round Ingot	Diameter	Length
	4½/32 (large end)	16
	3½/16 (small end)	
Extruded Stick	Diameter	Length
	0.65	12
	0.92	12
	1.3	12
Turnings	1.3	24
Industrial Grade	0.010 x ⅛ x ¼	100 or 200
Pharmaceutical Grade	0.010 x ⅛ x ½	lb. drums

Magnesium Alloy Ingot and Billet. Standard alloys are furnished in the form of ingot for remelt, cast extrusion ingot, cast forging ingot, extrusion billet and forging billet. Other alloys should be made the subject of special inquiry.

Magnesium Sheet and Plate Products. The magnesium sheet and plate products are produced in three alloy compositions. AZ31B, a magnesium-aluminum-zinc alloy, is for general use at moderate temperatures. A magnesium-thorium-zirconium alloy, HK31A, and a magnesium-thorium-manganese alloy, HM21A, are supplied for use at temperatures up to 800°F and above.

Flat Sheet and Plate
Coiled Sheet
Sheet and Plate Circles
Foundry Pattern Plate
Tread Plate

Mechanical Engraving Plate
Mill Primed Panel Stock
Special Bending Sheet
Tooling Plate
Electrochemical Sheet

Extruded Magnesium Products. Magnesium extrusions are available in three alloy types. First is the magnesium-aluminum-zinc series: AZ10A, AZ31B, AZ61A and AZ80A for general purpose usage.

Second is ZK60A, a magnesium-zinc-zirconium alloy with improved strength. Third, for elevated temperature usage up to about 800°F and above, HM31A, a magnesium-thorium-manganese alloy, is supplied.

Anodes
Rod, Bar and Solid Shapes
Hollow Shapes
Semi-Hollow Shapes
Structural Shapes
Tube
Pipe

Extrusion Billet
Forging Billet
Precision Extrusions
Primary Magnesium
Extruded Sticks
Welding Rod and Electrode
Wire

Photoengraving Metal and Chemicals. Magnesium has many advantages as a photoengraving metal, and The Dow Chemical Company supplies a special grade of magnesium sheet, plate and extruded tube for direct printing on cylinder presses.

Along with photoengraving sheet, plate, and tube, Dow has developed a revolutionary DOWETCH® powderless etching process for the one-step engraving of magnesium. The chemicals for the new process are formulated and packaged by Dow and are distributed as "DOWETCH Chemicals for Etching Magnesium."

These chemicals, which include DOWETCH Concentrate A, DOWETCH Concentrate B and DOWETCH Extender, are used in a one-step, flat plate etching process. The most recent addition to Dow's line of photoengraving chemicals, designated DOWETCH C-1, is used in conjunction with the other three chemicals for one-step etching of curved segments and extruded tubes.

Details regarding the DOWETCH process can be obtained by writing to The Dow Chemical Company, Metal Products Department, Midland, Mich. 48640.

Melting Fluxes. Dow sells fluxes for use in melting and refining magnesium and aluminum and for introducing manganese into molten magnesium. Dow's position in raw materials and production capacity lends itself to offering fluxes for non-magnesium metal operations such as ones involving aluminum and zinc. Other inorganic salt mixtures used in the metals industry are also available.

precision fabrication service

Utilizing the specialized metal fabricating knowledge gained during the operation of the Rocky Flats Division for some 13 years, Dow in 1964 established a plant for Precision Fabrication Services at Denver, Colorado.

The plant applies numerical control machining principles to all types of common metals, ceramics, high-temperature alloys, etc. A high quality, fast turn-around service at commercially competitive pricing is offered. Plant equipment is principally designed around the 4-axis N-C, Omnimil No. 2 and the Model No. 21 3-axis N-C machines built by Sunstrand Corporation, both of which have continuous path 0.0001 pulse Bendix control. Inquiries should be addressed to:

Precision Fabrication Services
P. O. Box 20337
Denver, Colorado 80220
Phone (303) 399-0263

TEXTILE CHEMICALS

APO (tris (1-aziridinyl) phosphine oxide) is a finishing agent used to impart wrinkle resistance and flame-retardant properties to textiles and as a binder for anchoring dyes to fabric. By use of APO in conjunction with certain dyes, cotton fabric can be dyed and made wrinkle-resistant in a single operation.

TUASAL 85 and TUASAL 100 antimicrobial agents are employed as bacteriostats and fungistats in textile finishing.

A broad range of other Dow products find application in the textile industry as anticorrosion additives, antifoam agents, antistatic agents, biocides and preservatives, binders and sizing agents, chelating agents, coatings, coupling agents, delustrants, dispersing agents, dyeing and printing assistants, dye strippers, emulsifying agents, fabric conditioners, fade-resistance agents, flocculants, kier boiling assistants, plasticizers, scouring agents, softeners, solvents, spotting agents, weighting agents, wetting agents, yarn lubricants, etc. Specific information concerning the Dow products used in these applications is available from Dow's Technical Service and Development Department, 2020 Building, Midland, Michigan 48640.

HIGHWAY PRODUCTS

Calcium Chloride is used to control dust on unpaved roads, streets and parking areas; provide bare pavement maintenance in highway ice control; freeze-proof abrasives used to skidproof icy roads; provide uniform moisture content in the stabilization of granular soils; and accelerate the set of, and provide high

early strength, in concrete. Dow produces several forms of calcium chloride, both dry and liquid. These products and their properties are listed on page 19.

Surface Modifiers 1-A and 2-A are additives utilized to improve the performance of asphaltic mixes for paving road surfaces; Surface Modifiers 1-M and 2-M are additives for portland cement which is to be applied to metal surfaces subject to abrasion or erosion; and Surface Modifiers 1-C and 2-C are additives for portland cement for resurfacing concrete bridge decks and roadways.

STYROFOAM HI polystyrene is a blue, multicellular expanded foam in board form which is intended for use as a construction material to control frost action under highway pavements and to prevent freezing of pipelines or other utilities which are placed underground.

OIL WELL AND SPECIAL SERVICES

Dowell Division of The Dow Chemical Company, offers numerous services and products to the petroleum production industry. Generally speaking, these services and products are designed to improve the producing characteristics of oil and gas wells, or to increase the efficiency of their operation.

Dowell services and products are offered from more than 150 offices and stations throughout the oil fields of the United States. Associate companies also offer Dowell services and products in Canada, South America, Europe, Africa and the Middle East.

Fracturing Services. Many types of formation fracturing services are provided by Dowell, all intended to increase the effective draining area—and hence the production—of wells. To accomplish fracturing, either hydraulic or chemical-hydraulic techniques may be employed. Fracturing fluids are of many types, each developed to provide easy application, easy return following treatment, and maximum increase in production. The fluid used on a particular job depends upon the characteristics of the well and the producing formation. A variety of addition agents and formation propping materials are also used to make fracturing more effective. Dowell has extended the benefits of both chemical and hydraulic treatments to nearly every producing horizon.

Acidizing Services. Acidizing is essentially the introduction of inhibited hydrochloric acid into subsurface formations to improve their producing characteristics. The acid reacts with the formation, enlarging the cavities and channels and thereby causing a definite increase in the permeability. Acidizing is useful in both completion and workover operations in oil, gas and water wells. It is also used to control gas/oil and water/oil ratios; to loosen stuck drill pipe; to remove carbonate mud, cement, and carbonate scale; to dissolve bentonite and clay from sand formations; to disintegrate mud sheaths; and to increase the capacity of input wells. Numerous acids and addition agents are available from Dowell.

Cementing Services. Dowell offers a broad range of cementing services for oil and gas wells—from primary to squeeze-type cementing. These services are engineered to provide maximum protection for wells. Several different basic cement slurries and a variety of special additive materials are used to meet specific well conditions.

Equipment Rental. Dowell offers a line of skid-mounted units—on a rental basis—for fracturing, acidizing, cementing and other well-servicing operations on offshore rigs and remote land locations. Also, Dowell's regular pump trucks are available—on

a rental basis—for a great variety of miscellaneous oil field pumping jobs.

Special Services. A number of special services which have proved helpful to oil and gas well operators are available from Dowell. Included are ABRASJET® abrasive jetting service for formation cleaning or casing perforating; temporary plugging services; sand control and consolidation services; plastic services; and wire line measurement surveys.

Bulk and Packaged Products. The products Dowell offers to well operators include: CORBAN® corrosion inhibitors to prevent the corrosion of metal well equipment; paraffin solvents; EZEFL® low-pour-point surfactant; DETERGER® surfactant; FREFLO® surfactant; VERSENE 100 chelating agent to remove difficult scale deposits; paraffin dispersants to prevent the formation of paraffin deposits; plastic pipe and tubing; polyvinyl chloride pit liners to prevent salt water seepage; MUDBAN® mud-dispersing agent; GYPBAN® calcium sulfate inhibitor used to prevent the deposition of gyp scale; HEVIWATER® packer brine and completion fluid; INSTANT ACID® dry acid in granular form; foaming agents used to unload water or oil from wells; and inhibited hydrochloric acid for a variety of oil field uses.

Missile Cleaning. One of the most interesting operations carried out by Dowell Division is the cleaning of missile components and propellant loading systems. Unless these parts are completely free of dust, dirt and traces of hydrocarbon, the missile may be thrown off course or even blow up. Missile component cleaning is carried out in special "white rooms" in a surgically clean environment and utilizing specialized techniques. Cleaning removes all foreign particles larger than 150 microns and all hydrocarbons. Mobile cleaning facilities are available for cleaning equipment that cannot be moved, such as tanks.

Dowell also offers SEPARAN AP-30 flocculant, which is used in the coal processing industry to flocculate fines.

Detailed information may be obtained by writing to Dowell, Tulsa, Oklahoma 74114.

SECONDARY OIL RECOVERY CHEMICALS

The inefficiencies of water-flooding as a flooding medium for reservoirs having viscous crudes and/or wide permeability distributions have long been recognized. Water has a tendency to bypass or "finger" through viscous crudes, leaving substantial quantities of mobile oil untouched in the reservoir. This occurs because the water is more mobile than the oil.

The Dow Flooding Process is a practical method of improving water-flood efficiencies and economics by controlling the mobility ratio between the injected water and the reservoir oil. This mobility control is accomplished by the addition of PUSHER® chemicals to the injection water so that the mobility of the water is decreased in relation to the mobility of the oil. Only small economical amounts of the chemical are required to achieve a reduction in the mobility of the injection water.

Dow will evaluate the effectiveness and economics of PUSHER chemicals with respect to particular reservoirs and provide equipment and advisory service on the application of these materials.

INDUSTRIAL CLEANING SERVICE

Dow Industrial Service, Division of The Dow Chemical Company, comprises several areas of industrial activity.

Chemical Cleaning Service. Dow Industrial Service provides chemical and mechanical cleaning of industrial equipment in refineries, pulp and paper mills, steel mills, utility plants, chemical plants and many other types of industrial operation. The range of equipment which may be thus cleaned is very broad, including boilers, heat exchangers, cooling jackets, condensers, evaporators, precipitators, process towers, tanks, and gas, water product and sewage lines.

Cleaning is on a contract basis. Experienced engineers perform the service and control every step of the operation. They bring with them all the necessary trained personnel, solvents, pump trucks, and controls. Solvents are formulated according to the deposit to be removed, inhibited, and then applied by the method best suited to the job—jet, foam, spray, fill and soak, cascade, steam, or emulsion cleaning. A wide range of solvents is utilized, including organic and inorganic acids, alkalies, and chelating solvents. Necessary additives such as wetting agents and inhibitors are included in the formulation to improve the action of the solvent and protect the equipment.

The solvents reach wherever steam, water or solvents can go, removing deposits from places inaccessible to other cleaning methods. Dismantling and downtime are held to a minimum, and often equipment can be cleaned while in operation.

Boiler Water Treatment Service. A new concept for in-service cleaning and scale prevention in industrial boilers has been developed, tested and made commercially available. In the new treatment, VERTAN® 600 alkaline chelating agent replaces the conventional phosphate, sludge conditioner and antifoam treatment. This chelating agent not only prevents deposits from forming in boilers, but also removes existing deposits. The salesmen who handle VERTAN 600 are engineers with years of experience in chemical cleaning, and are therefore well qualified to discuss specialized cleaning problems.

BLASTING AGENTS

A program of research and development, dating from 1953, has led to the development of a series of metalized ammonium nitrate blasting agents. These products have harnessed the high energies of burning metals in a formulation so safe to handle that the finished products bear a shipping classification no more hazardous than that of fertilizer-grade ammonium nitrate. A series of nine products is now being manufactured in a new production facility near Biwabic, Minnesota. These blasting agents offer the explosives user a wide variety of rock-breaking characteristics, which, when coupled with Dow's new technology in rock mechanics, can offer significant economies in most blasting situations. The Dow family of blasting agents are offered in color-coded plastic tubes. In the iron mining districts of Michigan and Minnesota, they may be pumped directly into the blast hole by bulk-loading units.

INDUSTRIAL WELDING AND CUTTING FUEL

MAPP® industrial gas is a stabilized mixture of methylacetylene and propadiene that is used as an industrial

welding and cutting fuel. It combines the high flame temperature of acetylene with the safety and ease of handling of propane. Major marketing areas include cutting, heating, metallizing, flame hardening, underwater cutting, welding, brazing, braze welding, and silver soldering. Cutting speeds exceed those obtained with natural gas, with less oxygen consumption. Bevels, pierces and other problem cuts are easier to make. MAPP may be utilized safely up to full cylinder pressure with no danger of decomposition. It may be used in bulk from tanks similar to propane tanks or from cylinders similar to propane cylinders. Shock sensitivity is equal to that of water. The only conversion necessary is to use special cutting tips that are marketed under the MAPP trademark through dealers handling MAPP. These cutting tips are available for any brand torch.

FIRE CONTROL POLYMER

GELCARD® water gelling agent is a synthetic polymeric material which in low concentrations converts water to a thickly gelled system. The primary application of water thickened with GELCARD is in fire control. The thickened water clings readily to vertical surfaces, building up a protective layer which has the ability to absorb large amounts of heat. Despite its high apparent viscosity, it can be pumped and sprayed with conventional fire department equipment in patterns and for distances almost equivalent to those obtained with pure water. Specific fire control applications include the prevention of exposure damage to buildings adjacent to fires and control of grass and brush fires.

INTERNATIONAL

A majority of the products described in this booklet are available for sale outside the United States and Canada through Dow sales subsidiaries. For a complete listing of their office locations, see inside back cover.

Dow products sold abroad are supplied from Dow plants in the United States or Canada or, increasingly, from Dow or Dow-affiliated plants in other countries around the world. Dow polystyrene is manufactured in the United Kingdom, France, Italy, Greece, India, Japan, Spain, Colombia and Australia; styrene in Australia, Japan and India; polyethylene and TYRIL resin in Japan; latex in The Netherlands and Japan; Saran resins in Japan and France; plastic films and foams in Japan; industrial chemicals in The Netherlands, Argentina, Mexico, Spain and Australia; agricultural chemicals in the United Kingdom, Colombia and New Zealand; metallic yarns in the United Kingdom and The Netherlands. During 1964-65, additional plants for industrial chemicals and plastics are scheduled to come on stream in The Netherlands.

These local plants combined with ocean-going chemical tankers and overseas stocking points assure rapid delivery of Dow products to customers around the world. In addition, through the spread of Dow plants and sales offices, international industry has ready access to Dow technical information and technical service from local sources.

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1,1,1-Trichloroethane see: CHLOROTHENE NU	12	ZETAFAK	35
1,1,2-Trichloroethane	12	ZETAFIN	32
Trichloroethylene	12	ZIP-TAPE	38
2,4,5-Trichlorophenol see: DOWICIDE 2	7	ZOAMIX	27
2,4,5-Trichlorophenol, Sodium Salt 1½ Hydrate		ZYTRON	26
see: DOWICIDE B	7		
2,4,6-Trichlorophenol see: DOWICIDE 2S	7		
1,2,3-Trichloropropene	12		
Trickling Filter Covers	29		
Triethanolamine	13		

*Boldface type listings indicate Dow sales names

†Developmental Item

THE DOW CHEMICAL COMPANY Executive and General Sales Offices, Midland, Michigan

AREA HEADQUARTERS

Dow Chemical Europe, S.A., *Zurich, Switzerland*
 Dow Chemical of Canada, Limited, *Sarnia, Ontario*
 Dow Chemical International, *Midland, Michigan*

PLANT LOCATIONS

United States

California, *Fresno, Pittsburg, Seal Beach, Torrance*
 Colorado, *Denver, Rocky Flats*
 Connecticut, *Allyn's Point*
 Florida, *Tampa*
 Hawaii, *Honolulu*
 Illinois, *Chicago, Madison*
 Indiana, *Indianapolis, Zionsville*
 Louisiana, *Plaquemine*
 Maryland, *Baltimore*
 Michigan, *Bay City, Clare, Jackson, Ludington, Midland*
 Minnesota, *Biwabik*
 Missouri, *Riverside*
 New Jersey, *Carteret*
 Ohio, *Cleveland, Findlay, Hanging Rock*
 Oklahoma, *Tulsa*
 Texas, *Freeport*
 Washington, *Kalama, Wenatchee*

Canada

Alberta, *Calgary, Edmonton, Fort Saskatchewan*
 British Columbia, *Ladner*
 Ontario, *Fort William, Sarnia, Toronto*
 Quebec, *Montreal, Richmond*

Europe

England, *King's Lynn*
 Germany, *Greftern*
 Greece, *Lavrion*
 Holland, *Rotterdam, Terneuzen*
 Italy, *Livorno*

Latin America

Argentina, *Buenos Aires*
 Colombia, *Bogota, Cartagena*
 Mexico, *Mexico City*

DOMESTIC DIVISIONS

Bay Refining, *Bay City, Michigan*
 Brazos Oil & Gas Company, *Houston, Texas*
 Dow Aerospace Services, *Titusville, Florida*
 Dow Industrial Service, *Midland, Michigan*
 Dowell, *Tulsa, Oklahoma*
 Pitman-Moore, *Indianapolis, Indiana*

PRINCIPAL PARTLY-OWNED COMPANIES

Asahi-Dow Limited, *Tokyo, Japan*
 Bio-Science Laboratories, *Los Angeles, California*
 Cliffs Dow Chemical Company, *Marquette, Michigan*
 Compagnie Des Services Dowell Schlumberger, *Paris, France*
 C.S.R.C-Dow Pty. Limited, *Melbourne, Australia*
 Distrene Limited, *London, England*
 Dow Badische Company, *Williamsburg, Virginia*
 Dow Corning Corporation, *Midland, Michigan*

Dow-Unquinesa S.A., *Bilbao, Spain*
 Dowsmith Inc., *Milwaukee, Wisconsin*
 Ethyl-Dow Chemical Company, *Freeport, Texas*
 Ivon Watkins-Dow Limited, *New Plymouth, New Zealand*
 The Kartridg Pak Co., *Davenport, Iowa*
 Laboratorios Industriales Farmaceuticos Ecuatorianos Life, *Quito, Ecuador*
 Ledoga S.p.A., *Milan, Italy*
 Plastichimie S.A., *Paris, France*

SALES OFFICES

(Other than U.S.)

Canada

Calgary, *Alberta*
 Montreal, *Quebec*
 Saint John, *New Brunswick*
 Toronto, *Ontario*
 Vancouver, *British Columbia*
 Winnipeg, *Manitoba*

Europe /Africa Area

Athens, *Greece*
 Bilbao, *Spain*
 Brussels, *Belgium*
 Capetown, *Republic of South Africa*
 Copenhagen, *Denmark*
 Durban, *Republic of South Africa*
 Frankfurt, *Germany*
 Johannesburg, *Republic of South Africa*
 London, *England*
 Madrid, *Spain*
 Milan, *Italy*
 Oslo, *Norway*
 Paris, *France*
 Rotterdam, *Holland*
 Stockholm, *Sweden*
 Turin, *Italy*
 Vienna, *Austria*
 Zurich, *Switzerland*

Latin American Area

Bogota, *Colombia*
 Buenos Aires, *Argentina*
 Caracas, *Venezuela*
 Guatamala City, *Guatamala*
 Lima, *Peru*
 Mexico City, *Mexico*
 Rio De Janeiro, *Brazil*
 San Juan, *Puerto Rico*
 San Salvador, *El Salvador*
 Santiago, *Chile*
 Sao Paulo, *Brazil*

Pacific Area

Hong Kong, *British Crown Colony*
 Kuala Lumpur, *Malaysia*
 Manila, *Philippines*
 Melbourne, *Australia*
 Osaka, *Japan*
 Sydney, *Australia*
 Tokyo, *Japan*
 Wellington, *New Zealand*



SALES OFFICES

ATLANTA, Ga. 30303
618 Fulton Natl. Bank Bldg.

BOSTON, Mass. 02167
1330 Boylston St., Chestnut Hill

BUFFALO, N. Y. 14202
560 Delaware Ave.

CAMDEN, N. J. 08102
400 Market Street

CHARLOTTE, N. C. 28202
200 South Tryon St.

CHICAGO, Ill. 60648
6000 W. Touhy Ave.

CINCINNATI, Ohio 45227
Colonial Center Bldg.

CLEVELAND, Ohio 44113
55 Public Square

DALLAS, Texas 75202
1401 Elm Street

DETROIT, Mich. 48235
600 Northland Towers

HOUSTON, Texas 77025
6910 Fannin Street

INDIANAPOLIS, Ind. 46208
3909 No. Meridian St.

LOS ANGELES, Cal. 90054
2600 Wilshire Blvd.

MINNEAPOLIS, Minn. 55424
4901 West 77th Street

NEW ORLEANS, La. 70112
1100 Commerce Bldg.

NEW YORK, N. Y. 10020
45 Rockefeller Plaza

PITTSBURGH, Penn. 15222
Four Gateway Center

ST. LOUIS, Mo. 63105
10 South Brentwood Blvd.

SAN FRANCISCO, Cal. 94106
350 Sansome St.

SEATTLE, Wash. 98121
307 Broad Street

Dow Chemical of Canada, Limited—Executive and General Sales Offices, Sarnia, Ontario

THE DOW CHEMICAL COMPANY



MIDLAND, MICHIGAN